UNITED STATES NAVAL INSTITUTE PROCEEDINGS

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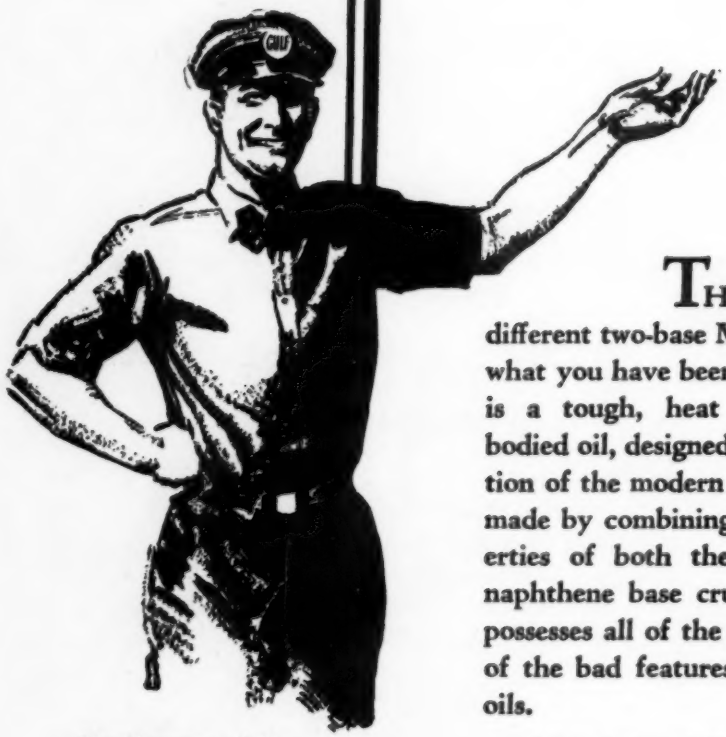

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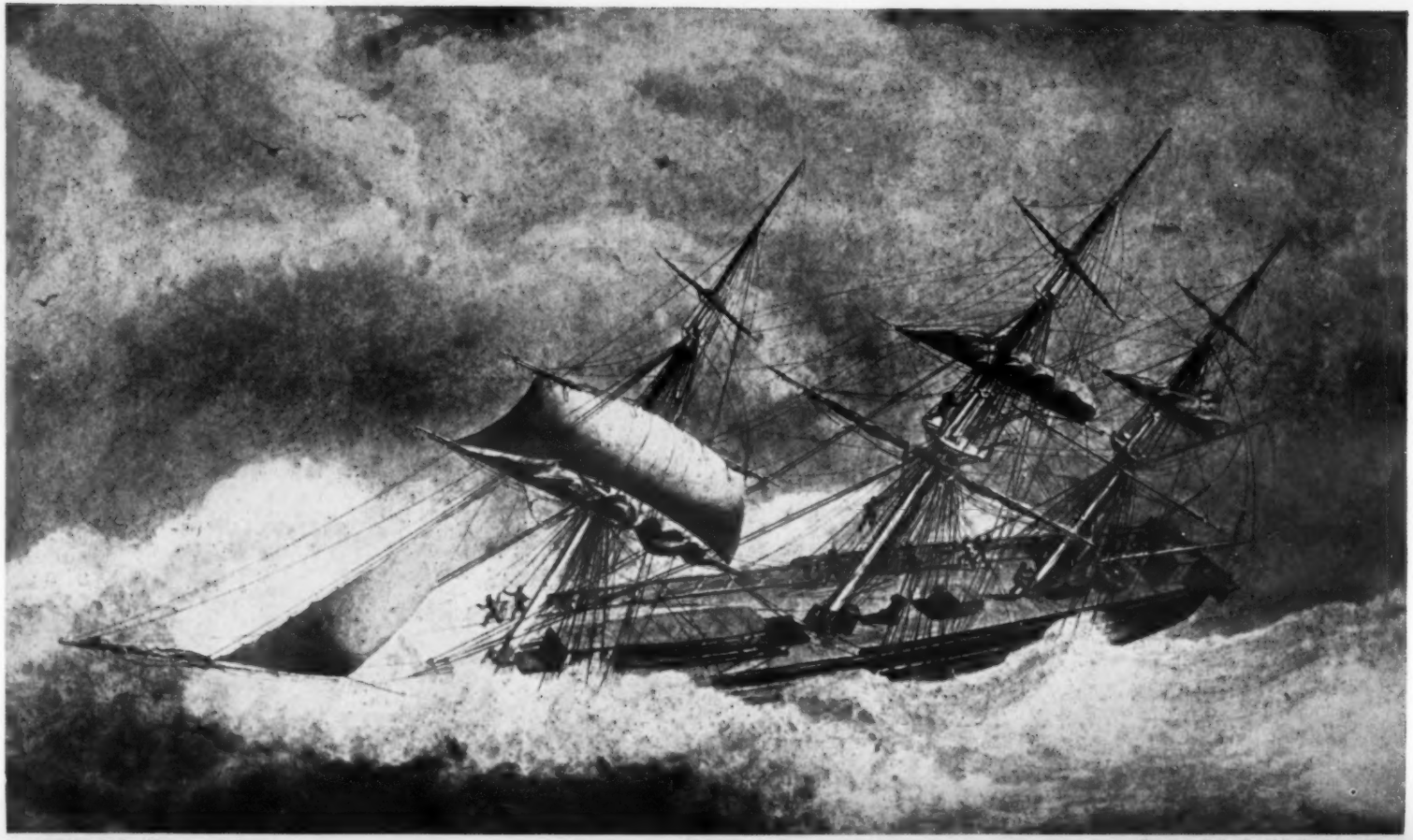
BOMBARDMENT OF ISLAND "NUMBER TEN" IN THE MISSISSIPPI RIVER, MARCH-APRIL, 1862



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SHIP *RUBICON* OF BOSTON, 487 TONS

From a Painting by Frederic Roux

Courtesy Peabody Museum, Salem

SHIP *RUBICON* OF BOSTON, 487 TONS

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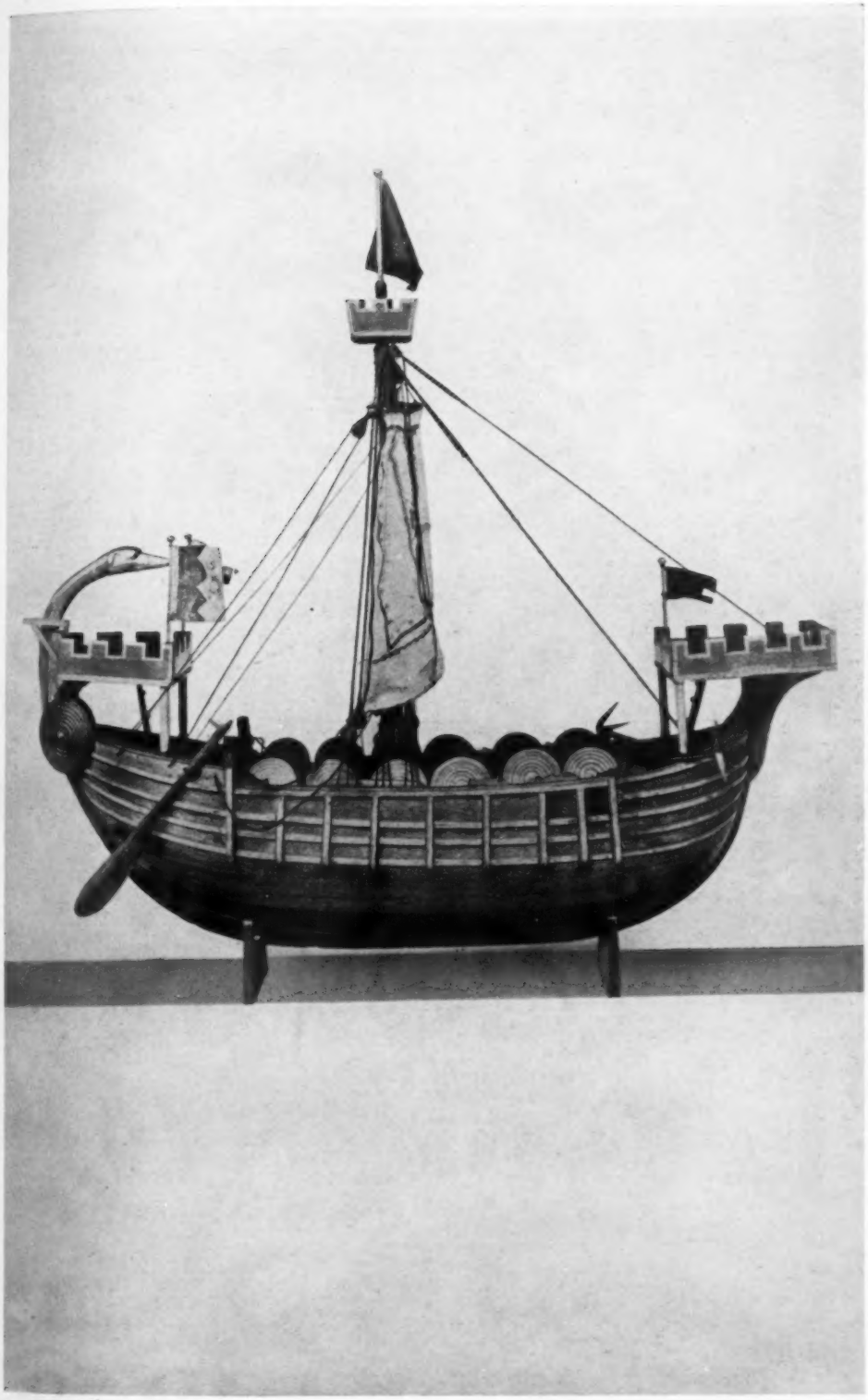
Courtesy Naval War College

ENGAGEMENT IN CHESEME BAY BETWEEN THE RUSSIANS AND TURKS, JULY, 1770

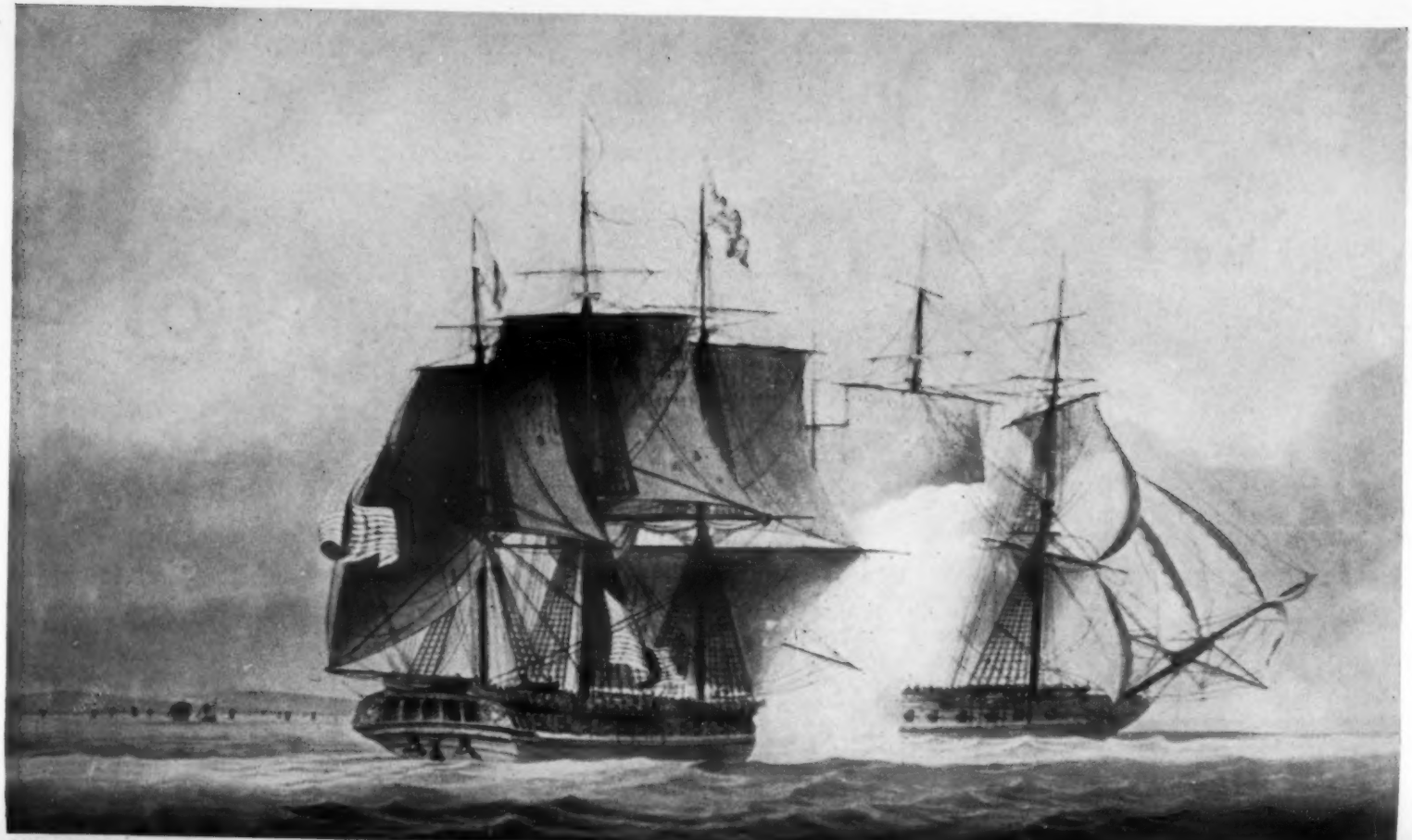
Courtesy Naval War College *Macpherson Collection*

THE BATTLE OF LA ROCHELLE, 1732



Courtesy Naval War College

MODEL OF A KING'S SHIP OF THE LATE TWELFTH OR EARLY THIRTEENTH CENTURY
This model from the Science Museum, South Kensington, shows the lightness of the fore and after castles.



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CHESAPEAKE VERSUS *SHANNON*

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CHESAPEAKE VERSUS SHANNON

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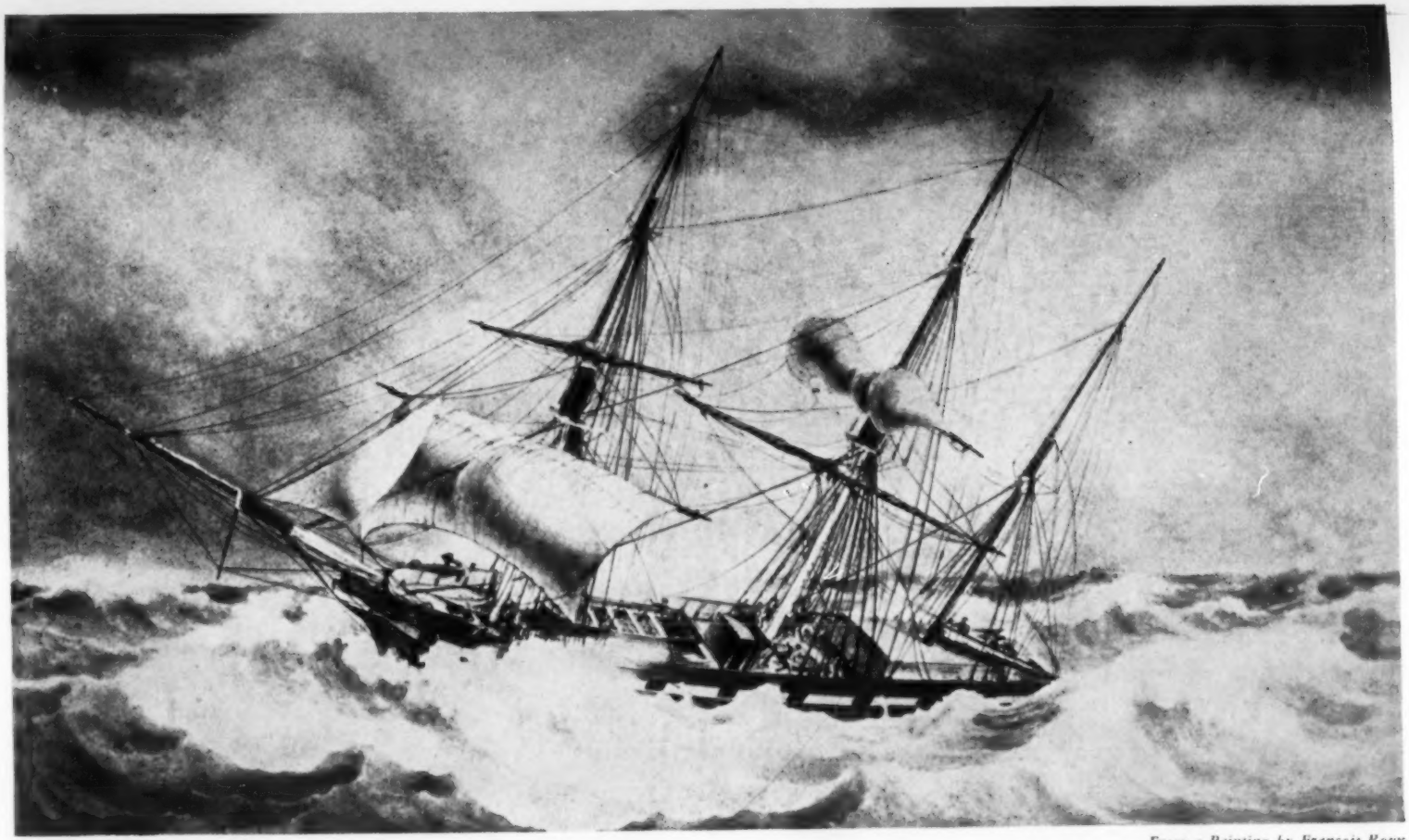

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FRENCH BARQUE *IRMA* IN A GALE, DECEMBER, 1839

From a Painting by Francois Roux

Courtesy Naval War College *By Courtesy Robert Dunthorne and Son*

MODERN MODEL OF THE *SANTA MARIA*

The *Santa Maria* was the flagship of Columbus in his great voyage of discovery. The manner in which the sails were increased by lacing bonnets to the lower edge is clearly shown in this fine model made by Lieutenant Colonel Harold Wylie.

e and Son

anner in
this fine

Courtesy Naval War College

Macpherson Collection—(From a Lithograph Published by Currier and Ives, 1862)

FARRAGUT'S FLEET PASSING THE FORTS ON THE MISSISSIPPI

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. No. 57, No. 2 FEBRUARY, 1931 Whole No. 336

FARRAGUT AT THE CROSSROADS

By Albert Mordell

ADMIRAL DAVID FARRAGUT'S deeds of bravery were not only those he performed when he ran his fleet by the fortifications below New Orleans, or ordered his flagship through the torpedo-mined channel into Mobile Bay. He did an almost equally fearless act on April 18, 1861, the day after Virginia's secession, when he, a born Southerner, defied the most hostile public sentiment and left Norfolk, his home for the preceding forty years to go north to offer his services to the Union cause. It is often as difficult to reach a decision requiring moral courage, as to perform an act involving physical prowess; but to Farragut both courses came naturally. Moreover, Farragut's conduct on this occasion was the chief turning point in his life, and eventually became of most vital consequences to the nation. For it was because he left Norfolk under the circumstances he did, that he was chosen by the Secretary of the Navy to lead the New Orleans expedition; and it was his success in this, as well as at Mobile, that hastened, if not actually brought about, the end of the war.

The circumstances of Farragut's leaving Norfolk, so consequential to himself and so momentous to the nation, assume thus the interest of an event of great national importance. In fact it would be no exaggeration to say that if Farragut had not left Norfolk it is possible that the South might have been today an independent republic; for as Charles Francis Adams has pointed out, it was the maritime supremacy of the North that crushed the South. And no one but Farragut was able to make that supremacy attain its maximum of power. Only his victories made possible Grant's operations in Virginia and Sherman's march to the sea. And the French government had been about to recognize the Confederacy before Farragut took New Orleans.

Farragut's determination to quit Norfolk brought out the most heroic qualities in his character, and the most conspicuous features of his mental make-up. His conduct here showed the same quickness and daring of judgment that characterized his action in battle. We see his patriotism, his unselfishness, his firmness, his sincerity. Only the latent genius to be revealed later was not yet apparent. But the episode gives the clue to his subsequent career and sheds light on the entire nature of the man.

First, there can be no doubt as to the fact that because of his leaving Norfolk, he was chosen to capture New Orleans. We have the words of the Secretary of the Navy, Gideon Welles himself, who states in his now celebrated diary what made him select his man. Once the plan of the expedition had been decided upon, the difficulty was in finding someone who would victoriously execute it. At the time Farragut's name was unknown even to Lincoln, for he had little war experience, and that chiefly when he was a boy. Nor were his Southern affiliations in his favor, when it came to choosing him. But let Welles tell the story:

> Farragut became a marked man in my mind when I was informed of the circumstances under which he left Norfolk. At the time the Virginia

FARRAGUT'S FLEET PASSING THE FORTS ON THE MISSISSIPPI

MacPherson Collection—(From a Lithograph Published by Currier and Ives, 1862)

Courtesy Naval War College

Convention voted to secede he denounced the act, and at once abandoned the state, leaving his home and property the day following, avowing openly and boldly, in the face and hearing of the rebels by whom he was surrounded, his determination to live and die owing allegiance to no flag but that of the Union under which he had served. This firm and resolute stand caused me not only to admire the act, but led me to inquire concerning the man. (Diary, volume II, page 116.)

Little has hitherto been known of Farragut's life in Norfolk during the last six months he spent here before Virginia's secession, though they form the most important half year hitherto in his life. He was living in the state which became the cynosure of the eyes of the nation, rather now of two nations, for on its final decision in the matter of secession hung the fate of the United States of America. Farragut was also living in a city which had the greatest navy yard of the country, the loss of which might be of disastrous consequences. He was in the midst of able naval officers, mostly of Southern birth, with whom he associated daily, who might have swayed him by their peculiar theories of allegiance to their state instead of to their country.

We can only learn something of the manner of Farragut's departure by a study of this ardent naval Unionist in this hostile environment. We must take into consideration local events and personages of the time and Farragut's connections with them. We must reconstruct the effect upon him of matters of national importance and particularly his reaction to the proceedings of the Virginia Convention, in which he took great interest. His final decision can be understood only by a recounting of the development of his opinions and sentiments. He himself has left testimony to the difficulties he had with brother officers, due to his ardent approval of Lincoln's course, a course that it then required the utmost hazard to sanction on the part of a Virginian. Farragut's son has given us but few details of the admiral's stay in and departure from Norfolk.

A correct study of the feelings, mind, and conduct of the man during this period explains his entire personality as well as his naval victories. The genial and much loved captain of sixty when he came back to Norfolk from a cruise to Panama in October, 1860, was on a leave of absence. He was drawing a reduced pay of $3,000. He was glad to get back here. He forgot the personal injustice under which he had only recently been smarting when he had been made to serve under an officer whose rank was lower than his own. Nothing could have been more galling to this veteran who was both proud and ambitious. However, he now had the company of his beloved Virginia, his wife of the last twenty years, and they were ideal mates for each other. She was a Loyall, one of the distinguished families, and her uncle, George Loyall, a man past seventy, a former congressman, was the Navy agent for the yard. Farragut was happy in the society of his wife and sixteen-year-old son Loyall, who was named after her family.

Farragut had been twice married, and his first wife had also been a Norfolk girl. He had married her nearly forty years before, but she had been an invalid during much of the sixteen years of their married life. Memories of her were also dear to him. Sisters of hers had also married naval officers, and relatives of hers were still here.

In short, there were plenty of relatives here on both of his wives' sides, though his own were in New Orleans and Pascagoula, Mississippi. But the associations here with old friends were far more numerous. Having himself been in the Navy for over half a century, and having served here in the yard and on receiving ships, he knew most of the naval officers. He was naturally acquainted with all those on duty across the river at the yard in Gosport. There were men here on leave of absence, like himself, or awaiting orders. There were others who were now old and on the retired list. Some of them had been on cruises with him, and had seen service with him many years before. The place brimmed too, with memories of his old naval friends temporarily elsewhere on duty, but who made occasional visits to the city.

Among his friends was "Ramrod" Dick Page, commanding at the rendezvous. He was about six years younger than Farragut, and they had done ordnance duty together ten years before. There was Lieutenant Bob Pegram, who had been in the Navy for over thirty years, and had served with Farragut on the *Saratoga* in the little work they did in the Mexican War. He was at present engaged in coast survey. There was his dear old friend, Commander Arthur Sinclair, who lived over on Washington Street —the son of Commodore Arthur Sinclair, of

War of 1812 fame, and brother of two other men in the service, Lieutenant George T. Sinclair, and Dr. William B. Sinclair, both on duty at the yard, and also friends of his. How fond Farragut was of the brave Arthur Sinclair, who only two years before had rescued an American ship in the Pacific Ocean! He was about ten years younger than Farragut, and now on special duty.

He also knew Commander Charlie F. McIntosh, who had been in the Navy for over thirty years, and who was now in charge of a lighthouse—the same Charlie McIntosh who was to be killed later in the battle with Farragut at New Orleans.

Then there were men like Dr. Jim Cornick, who lived in Bermuda Street, had been forty years in the Navy, and had been surgeon on the receiving ship *Pennsylvania.* He was now awaiting orders. Old "Captain" Charles Kennedy was head of the Naval Asylum at Philadelphia, but often came to Norfolk. He was another veteran who had been forty years in the Navy. Captain Sam Barron, the nephew of the old commodore who killed Decatur, was visiting in Washington. He had been in the service as long as Farragut himself, and both had been on the *Brandywine* which had taken Lafayette back to France thirty-five years before.

All these men were Virginians; they had all come off sea duty within the last year or two. Every one of them had performed service with Farragut when he was second in command at the yard a dozen years before.

Norfolk at this time was a city of nearly 15,000 population, of whom far more than half were whites. Almost six years before it had lost 2,000 souls by yellow fever. Most of the people had lived here all their lives, and many of them came from old families. The naval officers gave the town its aristocratic tone and often married into these families. The people thought their city was beautiful because of a few attractive public buildings and the wide streets with large, square, colonial houses, and half a dozen courts. But the town was on a low, level section of the country and ill arranged and dirty. There was a religious and a moral atmosphere, but also signs of vice characteristic of seaports. There were over thirty saloons in the city and about half as many churches. Liquor merchants freely advertised their wares. Quacks sold remedies for baldness and bad blood. A few slave dealers did business here, but the commission and forwarding merchants preponderated over any of the others, while grocery stores where people met for discussion were everywhere.

Farragut was a man of about five and a half feet, firmly knit, somewhat stocky, and weighed about one hundred and fifty pounds. His agility and strength were manifest in his easy movements; in fact he was a man of athletic type. His face was large, oval, the cheekbones prominent and the cheeks full. His forehead was high and large, his nose crooked, large and pointed, his ears were a little too big, and his mouth a little too small. His complexion was very dark, naturally, because of the half Spanish blood he inherited from his father, and was now even darker because of the many tropical suns which had shone down upon it. He was still burned from his trip to Panama and his face was rugged and weather-beaten. Almost continually it showed a smile. This was due not only to his natural affability, but also to the fact that poor eyesight made him blink and partly close his hazel eyes. His hair was black and concealed a slight baldness. Everything in the man spoke determination: his prominent chin, his broad shoulders, his entire carriage. Yet it was apparent that he was genial, pleasant, democratic, and a good mixer.

Before Farragut arrived there had been talk of secession by South Carolina if Lincoln was elected. And everyone knew Lincoln would be elected because of the split in the Democratic party. Farragut himself was a Democrat, but like many naval officers probably did not vote at the election. The state, as well as Norfolk, went for the so-called Constitutional Union candidate. Farragut was for Douglas, who was strong for the Union, and had also spoken in Norfolk before the election. As a result of Lincoln's election Norfolk became excited about the proposed talk of South Carolina's secession.

"Miserable demagogues," said Farragut to his friends, "are they trying to bring civil war upon the country? As far as I remember, and as I once wrote to Boutwell—who was having some troubles in San Francisco, where I was at the time—the government has never interfered with the domestic troubles of the states when there was no collision with the United States laws and is studious of violating state rights."

He told how President Jackson, under whom his father had served, had sent him down on the *Natchez* in the spring of 1833, during the nullification troubles. Farragut had spent part of March in Charleston and understood the rebellious nature of the state. The secession was not a surprise to him. He said that one needed a Jackson today and that it was unfortunate that it was a Buchanan who was in the presidential chair at the time. He horrified all when he said force was necessary, for that is just what the people as a whole believed should not be used by the government. But Farragut had seen that if Jackson had not used a warship to enforce the revenue laws, they would have remained unenforced in spite of later compromises.

It was just about this time that meetings were being held in Norfolk to consider the interests of Virginia. The mayor, William W. Lamb, had inserted advertisements in the *Southern Argus,* a newspaper, of a citizens' meeting which was to be in the interests of the Union. On the other hand, minutemen organizations were being formed by the secessionists, who thought they were the direct spiritual heirs of the oppressed minutemen of the Revolution. Both factions held meetings within a few days of each other before Christmas, in Ashland Hall, near City Hall on Talbot Street. Its large, airy, lower room was often used for assemblages. Farragut rarely attended political meetings, but he was at the Unionist meeting. It developed that the citizens' meeting was not as strongly Unionist as he was, for they believed in state rights, slavery, secession, were only opposed to immediate secession, and were primarily interested in the state of Virginia. At the Secessionist meeting former President John Tyler made a nonunionist speech. A fine thing, thought Farragut, for a former president to do! And at one time he, Farragut, had gloried in the fact that he had entertained President Tyler and his new bride when they visited the receiving ship *Pennsylvania* at Norfolk, on which Farragut was stationed. As a result of the meeting, the minutemen adopted a uniform, and hereafter there appeared on the streets men in black Kossuth hats looped up at the right with a blue cockade and a state button in the center, blue woolen shirts with Virginia buttons on front, and black woolen trousers, each having a black belt with a plate designating the man's company.

Though Farragut did not think Virginia would ever secede, he did not like the looks of things. Yet everything is possible, he thought. "God forbid," he said, "I should have to raise my hand against the South." For he knew he would never go with Virginia unless the federal government let her go peaceably, which was not likely.

New Year came and went and within a few days again a Unionist meeting was held at Ashland Hall, and Farragut was much encouraged. He was irritated, however, and saw that things were ominous when he learned that on Alabama's secession two of the officers formerly under him on the *Brooklyn* still at Norfolk, a lieutenant and a master, resigned from the Navy because their state had seceded. These were among the first resignations in the Navy due to secession. "That is what will happen if Virginia ever secedes," he thought. "The officers will all resign." The ship itself a few days later left Norfolk for Hampton Roads, eight miles away, and the Norfolk people were in great excitement on hearing it was ordered to Charleston. There was broken a link in his associations, however, when his ship left.

Meanwhile, during the month of January things were happening so thick and fast both in the state and out of it, that for a while he felt as if he were whirled about in a gale. In the early part of the month, an extra session of the Virginia legislature convened on some pretext and the very next day went on record as against coercion—the great bugaboo of all Virginians. Even President Buchanan was against coercion. "How can one have a government if it is not supposed to have the right to enforce its laws?" thought Farragut. As an officer he was strict in enforcing obedience to orders and in punishing for their infraction. Yet every one around him took it for granted coercion would be an act of war by the government.

But real excitement prevailed in Norfolk when the legislature discussed the bill calling for a state convention to consider the question of Virginia's secession. The bill passed and the matter was to be left to the people, who would choose their delegates next month. The legislature, however, appropriated $1,000,000 for the state's defense. "Against whom?" Farragut wondered.

Meanwhile one state after another was seceding until by the beginning of the following month six states had left the Union. Farragut was in despair as he saw his country broken up.

Towards the end of the month there were meetings to nominate delegates to the convention at Ashland Hall, where a Secessionist candidate was selected. At Mechanic's Hall there was a meeting to choose the Union candidate. Mechanic's Hall was a few doors east of Market Square. It was a ninety-foot building of Tudor Gothic order. Farragut attended the meeting at Mechanic's Hall. For the first time he was active in politics. He was in favor of the Union candidate, General George Blow, Jr., and remained till the early hours of the morning listening to the speeches. He worked with his friend "Dick" Page to get Blow votes.

Thus the month of January passed. Now that his country was broken up it was his interest to fight for Virginia's retention in the Union. The country was, in his view, to be saved only by force. The peace conference to be held at Washington in February, he was sure would fail, as it did. The seceded states were already forming a new government. What would Virgina do on the election of February 4, when the convention delegates would be elected? He felt that the state, like Norfolk itself, was Unionist. Two of the leading newspapers in the city, the *Day Book* and the *Herald*, were for the Union. The whole nation was almost as eager for the results of the election as if it were a presidential election. The streets and halls were full of speakers haranguing the people to vote for one or the other candidate. Farragut himself listened eagerly to them. The great day of the election came. He cast his vote, and felt that he had never before voted in a better cause. The results the next day showed that not only Norfolk city but the county and the entire state had gone Unionist. Norfolk chose the Union delegate, who received a plurality of more than 500 votes over the Secessionist candidate in the more than 1,400 votes cast. The county had also chosen two Union delegates by a vote of 800 more than the Secessionist candidates. The state had given the Union 60,000 majority. The North rejoiced and was now assured that the state was saved.

Farragut himself felt his own personal difficulties were over. He would not have to leave his state or fight against it, for he would never have gone away with it if it had voted for secession. All his private tribulations were over. He would not have to leave his family or become the enemy of his personal friends. He went to sleep that night happy that Virginia had been saved for the Union, for the people themselves had spoken. No convention would dare go against the wishes of its constituents. February 4 was an important day in American history. On that day, he thought, Virginia was saved for the Union; the peace conference met in Washington; and the Southern Congress met in secession in Montgomery, Alabama.

The Norfolk *Herald* said, commenting on the election, that it was happy because Virginia was not to dance crazily out of the Union to the fiddling of South Carolina.

But Farragut, like many others, even Secessionists, and the entire North, was deceived in the significance of the election. One Richmond paper, the rabid Secessionist *Inquirer*, read the signs of the times better. In short, a Virginia Unionist was more akin to a Secessionist than he was to a Black Republican, as he himself called a Northern Unionist. The Virginia Unionist believed in the same doctrines as the Secessionist, but differed only in the question as to the expediency of immediate secession by the state. Farragut was to learn later on that he had been too sanguine in his hopes about Virginia's remaining in the Union. Meanwhile, he looked to the day of the opening of the convention at Richmond on February 13. Possibly no more important convention had ever met in the country since the Constitutional Convention.

The month of February passed and all sorts of resolutions were passed by the convention, but it got nowhere. It was waiting like the rest of the country for Lincoln's inaugural address. What would Lincoln do? The day came when the famous address was published. A wave of indignation spread throughout the South. It made Secessionists in Virginia because it was looked upon as a declaration of war. Farragut thought it conciliating enough and when he approved of it he had his first real clashes with his friends. He was almost alone in his defense of it. His two favorite Unionist papers im-

mediately turned Secessionist. The effect of this document was, in the opinion of all, foreboding of disaster. In spite of the fact that there was already a new country formed of seven states, with a President and Constitution, the rail-splitter said he considered the Union unbroken. It was plain he talked as if he never had heard of the Southern attititude on the subject of coercion. He declared he would use force.

Said the editorial in the Norfolk *Day Book*, on the occasion of the inaugural address: "Lincoln, the wild political despot of the West, whose head has been crazed by the doctrines and isms of Horace Greeley, has proclaimed to those who had patience to hope better things of him that they must hope no longer. His inaugural has gone forth to the world, carrying with it the declaration of coercion, fully and explicitly announced. It has told the millions of inhabitants of this country who hoped for peace from his lips that they shall have no peace. He proclaims to the South war, war, war. He has exposed his cloven hoof plainly and openly to the gaze of all, that they may be no longer deceived; and we must say that henceforth we can have but little patience with any Southern man who would pretend that there is yet hope."

One can imagine with what a hot blush in his cheeks Farragut read these words.

Even the Unionist delegates in the convention did not approve of the inaugural. Neither his wife's relatives nor his personal friends approved of it. But Farragut had confidence in his own views and judgment. He used to meet his naval-officer friends and acquaintances at a grocery store for discussions and would boldly state his opinions. He acted as if he really loved an argument. He was sure he was right though all were against him. They respected him, however, not only because he was older and higher in rank than most of them, but because they knew their man—his sincerity and high sense of duty and resoluteness. For the time they merely felt he had a right to his views, but were sure when the time came for Virginia to secede, which they thought she would eventually do, he would go along with her. It was not uncommon for Unionists to become converted to the Secessionist cause daily. Only they were puzzled how he, a man born in Tennessee, raised in New Orleans, and living in Virginia, could have such Black Republican sentiments.

Farragut was a great reader of newspapers, in spite of his bad eyes, for which he required glasses. He saw not only the Norfolk papers, but occasionally some of those from Richmond. The *Inquirer* published in full the entire proceedings of the convention, and all the speeches. It was these speeches that he would often discuss with his fellow-officers. He found very few of the speeches to admire. He cared little about the more rabid talkers. Occasionally he caught something that especially appealed to him and noted instances of courage that he praised. That March he wandered about the streets of Norfolk, sometimes as if in a daze. He was happy to learn that John S. Carlisle bravely espoused the Union cause, for he feared neither the hisses of the gallery nor the attacks of the *Inquirer*, to which he replied. Here was a man at least who could not be intimidated by being called Black Republican, and who even approved of Lincoln's doctrine of coercion. Farragut contrasted the speech of Carlisle with that of Tyler who had come from the peace conference to take his part in the convention Poor Tyler! He actually believed and so told the delegates that even Pennsylvania and New Jersey and New York City would join the Secessionists.

Meanwhile, the city was in constant turmoil. Somebody, whether as a joke or in earnest, had actually run a flag of South Carolina up on the staff in front of the naval rendezvous. Fears ran wild and it was thought an outbreak would take place because of the inaugural address. Volunteer companies were ready to patrol the town. The very children had caught the warlike spirit and paraded about. Across the river where Captain Charles S. McCauley was in command, things were just the reverse of what they were in town, too quiet for a crisis like the present one. Operations continued on a limited scale, and only a few of the dozen vessels or more there were being got available for early service. However, rumors spread through the city that Secessionist workingmen were being dropped and Union men being put in place, and the people became panic-stricken.

April came, and the next three weeks were the most hectic in Farragut's life so far. Some days he would remain at home in his house on Duke Street, out of sheer disgust, and try to forget everything. The house was in the residential section, a large square colonial house, with a large yard and trees about it. Everything was in bloom; nature was peaceful, but man warlike. He inhaled

the fragrance of the honeysuckles and noted the yellow jessamine and crimson woodbines, as he read his newspapers and commented to his wife about the events. She was in full sympathy with him. He would show his irritation at certain things in town, as when he read how some fool citizen on Wolfe Street had raised a Confederate flag, the stars and bars. He was in open revolt when he read that that hot-headed young orator, Roger Pryor, had come from the convention to address a crowd of citizens at Mechanic's Hall, and urged them to adopt resolutions instructing the Union candidate in the convention to vote for secession.

But the greatest piece of news soon came. On April 5 the convention voted against an ordinance of secession, and Farragut was again certain that Virginia was saved. One can understand what a terrible state of mind Farragut must have been in through noting a lapse of memory he later committed, which showed that the two months between the delegate election of February 4 and the convention vote of April 5, completely vanished from his mind. When he spoke at Mechanic's Hall, Norfolk, right after the end of the war, he referred to the final vote for secession of April 17 as coming a *few days* after the general election for delegates, confusing the Union victory at the February 4 election with the Union victory in the convention on April 5.

Psychologists tell us that we unconsciously forget painful periods in our lives; that that is nature's method of preserving sanity, a sort of healing process. In short, it is evident that those two months to Farragut were a nightmare of uncertainty, and it completely vanished from his memory.

However, in spite of the convention vote against secession, Farragut had not read things aright. The wish was father to the thought. He failed to see that the convention was made up chiefly of resistants, who all believed in the same principle whether they were for or against immediate secession. The "submissionists," as the ardent Unionists were called, were in the minority. He even failed to see that former Governor Henry A. Wise, whom he had known as a member of the Naval Committee of Congress some years before, was a Secessionist, in spite of his peculiar theories of fighting within the Union.

Yet he saw from his talks with his friends that they had the state of Virginia written on their hearts. They were more afraid of being traitors to Virginia than traitors to the government, as the North called them. They really believed that they were in the same position towards the North as their ancestors were to England in the Revolution. They differed from the North on a question of constitutional law, as to the relations of the state to the federal government, as to whether the state had become part of a nation or really remained one of a league of nations. State rights was part of their education. The North, they thought, wanted to interfere with a domestic institution, slavery. As a matter of fact, a Unionist to them was a Black Republican. Though they claimed the right of self-government freed from the tyranny of the North, they never thought of the negro having a right to self-government. In short, they wanted to be free, so as to prevent another group from becoming free. And to a man they were first and last for the right of secession and against coercion.

Along with his interest in the proceedings of the convention, Farragut was naturally concerned about what was going on in the navy yard, where he had often been on duty. It was the largest navy yard in the country. If the state were to go out of the Union, she would seize it as Florida had seized the Pensacola yard when she seceded. And his friend Captain McCauley, under whom he had served as commander twenty years ago on the *Delaware* in South America, was too old to take a decided course, loyal as he was to the Union. It had reached Farragut's ears, as it did even for people for whom it was not meant, that the Secretary of the Navy had given first verbal, and then written, secret orders, to get the *Merrimac* ready for service in the early part of the month. Strange to say, such news filtered out, whether through treacherous workingmen or officers Farragut did not know. He hoped it was not from the latter. He heard rumors that some of the officers pretended to their commander that the ship would be necessary for his own protection, if the city of Norfolk should attempt to seize the yard on secession of the state. Farragut was furious when he heard that McCauley had actually stopped work in putting guns on the frigate in spite of the receipt of the Secretary's orders. How could a cap-

tain in the Navy be so false to duty as to deliberately disobey orders?

Farragut knew the men connected with the yard. They were in some instances personal friends of his, though most of them were of Secessionist sympathies. Many of them had been in the service for thirty years or more, and had fine records. They represented the best traditions of the Navy. There were men who held the rank of commander, men like Robert G. Robb, at the head of the station, John R. Tucker, in ordnance, Thomas R. Rootes, in ordinary, and Fred Chatard, on the receiving ship *Pennsylvania*, and his great friend, Richard L. Page, at the rendezvous. There were a lot of fine lieutenants, men like C. B. Poindexter, Charles F. Spotswood, William Sharp, the two Sinclair brothers, George T. and Surgeon William B., nearly all of them natives of the state of Virginia. He knew or believed that they were loyal to the flag they served, at least while Virginia was still under that flag, though he was sure most of them would resign if Virginia left.

But Farragut's interest was changed to something else, more important than anything that had thus far transpired. On April 12 Fort Sumter was fired upon. Business at Norfolk came to a standstill. The people assembled everywhere, all excited and often cheering. Speakers sprang up everywhere. The local military paraded the streets with Southern flags. A volley of fifteen guns from the United States Artillery Company greeted the news of the firing upon Sumter. Farragut was shocked—was hurt painfully. Everyone else knew now that Virginia would secede, but even then Farragut hoped and believed that a majority endorsing secession would not be obtained. For the next few days he could not sleep.

He was wondering also why nothing was happening at Gosport. Why weren't the ships leaving? Like others he heard that on April 12 Chief Engineer B. F. Isherwood had been sent to get the *Merrimac* ready. Farragut had heard already that there had been an attempt to seize the navy yard. He heard as the rest of the city did, that the channel of the Elizabeth River leading from Hampton Roads to Norfolk had been partially obstructed by the Secessionists, by sinking two vessels there to prevent the ships from going out of the yard. He was sure that a big frigate like the *Merrimac* could not be endangered in leaving, however.

Farragut was afraid that all the ships and material would fall into the hands of Virginia if she left and thought precautions should be taken to prevent it. Here was $10,000,000 worth of property. Here were about 3,000 guns, and Farragut knew that if they were to fall in the hands of the Virginians, they could be transferred all over the South, to the Mississippi even, and that the Confederacy would be helpless without them, for it would take them a year to import or manufacture new guns. He saw them getting ready to send the *Merrimac* off, and yet he was fearful that at the last minute, if Virginia seceded, McCauley would not let her go. If only he were in command, he would save the yard if he had to turn his guns on the city of his residence and reduce it to ashes if it made an attempt to attack or capture the yard and its property. That is the kind of a man he was!

When the news of the President's call for 75,000 volunteers reached Norfolk, the city took on a warlike appearance. They dared the governor, Letcher, to respond to that insane demand and of course he refused, sending an insolent letter. How could they fight against their brethren in the South? The President was simply mad. They united more than ever.

Farragut's friends were eager to hear what he would say now. He surely could not approve of this course.

Farragut met them at the usual store.

"What else should Lincoln do?" he replied. "Why, the government's arsenals, navy yard at Pensacola, money in the mint at New Orleans, have been seized. Fort Sumter has been bombarded. Is it remarkable that the government of the United States should call for troops to sustain itself? Would Jackson have submitted to this? No, for I recall that I myself had the honor to be sent to South Carolina to support his mandate. This is not secession in the South; it is revolution—civil war. I have spent my life in revolutionary countries, and I know the horrors of civil war. And you may expect to experience what I have seen."

And he told them of what he had seen in Mexico only two years before at Vera Cruz, when there was civil war in the country. He told them of the retrograde condition

of the people, and of the ruins everywhere. He described the crumbling walls and the sordid soldiery. He also told of the time over thirty years ago when he was anchored off Buenos Aires, then besieged—McCauley and Sam Barron were with him then—of revolutions and counter-revolutions, of the barbarities committed on all sides, nightly assassinations due to the disbandment of armies, the suffering of commerce, of depreciation of currency. He spoke of men shot without trial and of towns that could not grow.

As he spoke his swarthy complexion grew blacker still, and the tan of Southern suns glistened and shone. He gesticulated, knitted his brow, half closing his hazel eyes; he would then open them widely, and they would light up with the sincerity of his cause. His prominent chin became more prominent and his aquiline, sharp nose seemed to protrude all the more.

And as he prophesied that such scenes as he had described would be witnessed in the South, they all called him "granny" and "croaker."

The talk then turned back to the Virginia convention, which had on the sixteenth gone into secret session. He still did not think the state would secede. They hinted, while others said outright, that if the state seceded they would send in their resignations to the government to remain loyal to the state. They did not feel that they could be traitor to the state. Some of them hoped the state would not go. They explained to him what he heard over and over again, that they did not care about politics—many of them did not even vote—but their duty was to their state. They could not be renegades and traitors. It was their state that gave them to the United States and if their state absolved them from their oath to the federal government, they would no longer be bound by it. Once they resigned and became private citizens, they were like any other citizen and could even honorably and conscientiously fight for their state or country against the nation they had recently served. They also explained that by doing so they were therefore not ungrateful to the government that had educated them. Their states had contributed taxes for that purpose and they themselves had given service in the past. As a matter of fact, they claimed that it would be a sacrifice to them to resign, for they were throwing up their life professions, with fixed incomes. They would now be going out rather late in life into an uncertain future. Some of them did grieve to leave the old flag under which they had served, but it was all a question of to whom their allegiance was due, and they concluded it was to Virginia. Others hinted that it was their wives who insisted that they resign.

Farragut could not see the matter in the light his friends did; he saw they were not independent thinkers; they were part of their community, and thought like it.

Was it possible that all his old ties were to be broken? he reflected. Would he lose them all, his old friends? In the main, his friends were Navy men and those in Norfolk were bound to him by the ties of many years. Would old Captain Charlie Kennedy and Jim Cornick go? He felt sure Pegram and McIntosh would resign. And so would the Loyalls; there was his wife's cousin, Benjamin, a brave young man who was on a cruise out on the African coast. And the young man's father, her uncle, the venerable George, would probably resign his civil position as Navy agent.

He was puzzled as to what Arthur Sinclair would do. That night he was at his home on Market Street. News had leaked out that the vote in the convention that day had been in favor of secession. Farragut, however, would not believe it. When he entered the house, Sinclair greeted him profusely. There were a few other officers there, among them Page. Sinclair was as sentimental as he was brave. He loved the flag, he loved his friends, he loved Virginia.

"What are you going to do, Arthur?" Farragut asked. "I hear Virginia has seceded, though I hope it is not true."

Tears came to Sinclair's eyes.

"I hate to leave the old flag, under which I have served thirty-seven years," he answered doubtfully.

"You served under it with Perry in Japan. Yes, and your father served under it too. It is nearly twenty-five years since he is dead. But I remember him here in Norfolk where he did duty as you and I have done. He was the man who superintended the building of my old ship, the *Delaware*. He fought at Lake Ontario, too."

"You know, my brother George has already resigned," Arthur replied. "Nearly everybody is going to resign."

"I know I will," said Page.

Farragut winced.

"I don't understand you fellows," he replied. "Why, Dick, you campaigned with me to keep Virginia in the Union."

"Yes," replied Page, "but she is out now, and I am going with her."

They argued and argued, and Farragut tried to persuade them not to resign. Tears again came to Sinclair's eyes as he realized that he would eventually go with his state.

Farragut left the house. The next day Sinclair resigned. He broke down and wept bitterly, as he told his wife what he had done, how he had severed his relations with the Stars and Stripes. Farragut never saw Sinclair again. He nearly came in contact with him at New Orleans the following year when Sinclair burned the unfinished *Mississippi* to prevent it from falling into Farragut's hands. Sinclair was drowned during the war a few years later in European waters. He was the grandfather of the novelist, Upton B. Sinclair. Arthur's son, Terry, who had just got an appointment to the Naval Academy, and the older son, Arthur, Jr., who had been serving under his father, also resigned.

Farragut hoped still that no secession would take place. The next morning, the eighteenth, the news came. Farragut was stunned. It could not be. But the vote was eighty-eight to fifty-five for secession. The men had betrayed their trust. They had been chosen as Union men. They had been intimidated. They had proved cowards. The vote by name was not made public, but it was said the Union candidate whom he helped elect, General George Blow, Jr., voted for secession. In short, he convinced himself that the state had been "dragooned" out of the Union, as he called it, a mistaken notion he always continued to have. He would never believe the state had honestly voted to go out. There was still hope left. The convention had left the question to be voted on by the people towards the end of May. He was sure they would never ratify secession. When he heard everyone say Virginia had seceded and that they now ought to seize the navy yard, he lost his temper. He went over to the store and met the officers, some of whom had already handed in their resignations.

He continued arguing, but now they would not listen. Some of them became antagonistic; who they were, history does not record.

The united opinions of the men made him more stubborn than ever. He was quick in making decisions and mentally he had already decided what he was going to do. He would become a refugee from his state; he would leave his wife and son, if they would not go with him. He would go away penniless, leaving his property; he would give up all the memories and associations of his home town, his friends and relatives—nay he would fight against them, and draw the sword on his friends. He would stick to the flag under which he had served for half a century. He had fought as a boy in the War of 1812 against his country's enemies, and he would do so as a man of sixty. In spite of the fact that he felt that in the North they might suspect his loyalty and that he might not be given a chance to serve, he would go.

"Mind what I tell you," he said to some who said they would resign, "you fellows are going to catch hell before you get through with this business." He did not often use profanity except when excited.

They told him now was no longer a time for argument. They wanted to know what he was going to do.

"I certainly cannot participate in measures hostile to the dictates of all loyal duty and to all the associations of my life."

They told him that his associations were here in Norfolk. They spoke of possible promotion here. His opportunities were great. They reminded him that everyone was resigning. The entire navy yard were handing in their resignations, except McCauley, who was a Northerner. His wife's uncle, George Loyall, had just resigned. What was he going to do? Was he not going to stand by his state? Was he going to become a renegade and a traitor? Was he not a Virginian? Some even uttered veiled threats of making him remain by force.

He arose to his full height and his eagle eyes flashed. "Gentlemen," he said determinedly, "I will see every man of you damned before I raise an arm against the flag."

"You will have to leave right away," said someone, "for a man holding your sentiments cannot live in Norfolk."

"Henceforth," he replied, "I cannot live here, and I will seek some other place where I can live."

"It's for the South's good," some one whispered, though not in his hearing.

"Of course you will not fight against your state," some one suggested. Farragut made no reply.

Farragut went back home in a daze. Everyone was resigning, or had resigned—Page, McIntosh, Pegram, and nearly the entire yard, including Sinclair's brothers.

Farragut bade good-by to an old lady acquaintance whom he met, and made signs as if washing his hands. She took this to mean that he would have nothing to do with the fighting, whereas he meant he was washing his hands clean of this mess into which his friends were plunging the country.

He went home to his wife. "Virginia, I am going to stick to the flag, and I am going to take the five o'clock boat for Baltimore. In short, I am going North."

She looked incredulous and pained. It meant leaving her mother and other members of her family. It meant breaking up the home ties of a lifetime. She hesitated.

"This act, Virginia, may cause years of separation from your family; so you must decide quickly whether you will go North or remain here."

She replied that she would go. He embraced and kissed her, overcome.

He consoled her, telling her he did not think this trouble would last very long. They packed a few valuables. He put a pair of pistols in his pocket. He knew that his life was not safe now because of his sentiments. He took Virginia and his son Loyall, and bade good-by to her mother who lived on Freemason Street. It was consoling to learn that the Loyalls still continued to think highly of him. He took a carriage for the wharf. He looked out at the old familiar streets. Everyone was rushing to and fro. All sorts of thoughts floated in his mind. He thought of himself, and he thought of his friends. He thought of what was going on in the navy yard. He heard that McCauley finally had refused to let the *Merrimac* sail, and that Southern troops were on the way to seize it. What would become of the yard? McCauley would surely not surrender it. He took the boat and bade a bitter farewell to Norfolk, the city he had first entered as a boy when he started on his naval career. Only yesterday every man here was his friend; today they were his enemies.

That night on board ship he was again sleepless. They reached Baltimore the next day. It was the nineteenth, and the city was soon in a riot, for the Northern troops were passing through. Citizens and soldiers were killed. It was a terrible experience for Farragut. It was a shock to his morale. But his destination was New York. He could not go to Philadelphia by rail, as a bridge had been destroyed, and he had to go on a common canal boat, on which there were crowded three hundred other refugees. He reached Philadelphia, and then New York, where a friend took him and his family in for a few days. He had meantime learned that the federal officers had burned the Norfolk Navy Yard, had sunk and scuttled all the ships except the *Cumberland*, on which they sailed away, and that the *Merrimac* was lost to the north. He burned with indignation at McCauley's conduct. All his friends at the yard, he discovered, had resigned. One must understand the man to know how he felt at this disgraceful episode, which was the greatest disaster and stain to the honor of the Navy he had served half a century. Little did he dream that this sunken *Merrimac*, believed to be utterly destroyed, would one day be raised and become the most formidable vessel of the Confederate Navy, and actually sink with most on board the only vessel, the *Cumberland*, which had been safely towed away. Little did he suspect that he would be fighting in New Orleans against some of these very guns he had seen in the yard. Above all, he never dreamed he would be personally fighting most of his friends, taking Page a prisoner, for instance, and least of all did he dream of becoming an admiral.

NOTE: The author has not enumerated his many authorities for the facts given. He has been greatly indebted to the numerous correspondents who have given him data known to them personally or through hearsay. With a few correspondents who maintained that at first Farragut said he would side with Virginia, the author is compelled to disagree, as there is so much testimony, including Farragut's own, to the contrary.

RECOMMISSIONING THE DESTROYERS

By Lieutenant Commander D. P. Moon, U. S. Navy

IN THE War of 1812, that indefatigable leader, Commodore Thomas Macdonough, faced with the problem of gaining control of Lake Champlain in order to stop an invasion from Canada, took his fighting men into the virgin forests on the shores of Lake Champlain. There they exchanged the musket for the axe and out of green timber fashioned the vessels which later bore them to victory. Such a pioneer feat in wood cannot be duplicated today, yet its modern counterpart has been accomplished by the destroyer squadrons of the battle fleet.[1]

For nearly a year all normal operations and training of these squadrons ceased. In the place of such operations was substituted the functions of a seagoing navy yard in modernizing and recommissioning thirty-four destroyers from destroyers in reserve. No precedent existed for such an undertaking. Nevertheless the two squadrons immediately discarded "seagoing" habits and liberty blues to organize for the colossal task in hand. They have completed it and in the words of the commander in chief, U. S. Fleet,

> The recommissioning operation and the extent of work ordinarily done at navy yards which has been done by the forces afloat, including the *Medusa*, and the Destroyer Base, San Diego, form the most extensive program ever undertaken by the fleet. The manner in which the work has been carried forward and the quality of the work performed are commendable to the highest degree. The above remarks apply equally to the destroyers recommissioned on the East Coast.

How the recommissioning program was carried out adds an interesting page to the glorious history of the American Navy. It was in September, 1929, that such serious defects developed in thirty-four of the forty-two war-time destroyers assigned to this force as to cause the Navy Department to decide that these vessels had reached the limit of their usefulness. The department had a difficult situation to face in consequence of this decision.

In the first place the budget did not provide for anything more than the normal upkeep expenditures at the navy yard. In the second place, the absence of thirty-four destroyers from the battle fleet meant that it was gravely handicapped as an effective unit in the national defense. During the period of replacement the fleet would have been at the mercy of a major opponent with a balanced fleet. Replacement at the earliest possible date and at a minimum of cost was mandatory. The problem presented was somewhat similar to that confronting Macdonough in the War of 1812. But little money and no navy yard was available to him and time was valuable. Again, the Navy Department decided to rely upon the fighting forces to carry through another major pioneer undertaking. Macdonough had accomplished it in wood, could it be repeated now in steel?

As soon as it became apparent that the department might make some such decision, the squadrons' commander appointed a fact-finding board to obtain the necessary information for a proper estimate of the situation. This board examined the seventy-eight destroyers held in reserve at the destroyer base since the World War and listed all salient facts in regard to engineering, gunnery, and construction and repair. It was found that the ten-year wave of progress since the World War had not touched these destroyers. They had endured a Rip van Winkle sleep from which thirty-four were soon to be rudely awakened. While these thirty-four had been peacefully slumbering in the graveyard of the destroyer base the vessels which they were later to replace had received the benefits of numberless modern improvements. These improvements, however, had had no effect on staying the hand of time which had gradually sapped the vitality of their boilers and engines.

[1] The Ninth Squadron of the Scouting Fleet had a much similar problem in modernizing and recommissioning the Seventh Squadron.

When the decision of the Navy Department was finally made the instructions issued involved the shifting of masts, bridges in whole or in part, searchlight towers, radio installations, gyros, gun carriages and slides, torpedo tubes, torpedo and fire-control equipment, and pumps from the old destroyers to the new ones. Besides this shifting of equipment, the orders called for the wiring of torpedo and fire-control systems, the installation of ship's wiring, the installation of voice tubing, the retubing of condensers when required, the rearranging of magazines, the lifting of turbine casings, and finally the overhaul and conditioning of all machinery in addition to all the construction and repair alterations. The amount of welding, brazing, and ship fitting was beyond the conception of anyone. Even then, the job was not completed until the chipping, red-leading, and painting from stem to stern, of all ships inside and out, was accomplished.

Upon the receipt of the orders for the fighting forces to proceed with the modernization and recommissioning work, the commander in chief, battle fleet, called a conference with the squadrons' commander to discuss the situation. One of the general conclusions reached at this conference was that a tremendous job was being undertaken and that all possible help was to be given to assist the forces afloat. Immediately after this consultation the squadrons' commander called a conference of his principal subordinates. The general plans were laid, the allocation of vessels to the repair facilities, and the working hours for all hands were specified. Leave was to be discontinued except in emergencies and the hours of work were lengthened. Recommissioning was to be the paramount work of the force and every other activity was to be made subordinate to it. While the Navy Department had specified that all the time necessary was allotted for the work in hand, the admiral made it quite clear that the big job was to be accomplished as rapidly as efficient planning, removal of lost motion, and careful, thorough workmanship would permit. This idea was consistently followed.

The battleship divisions relinquished the services of the U.S.S. *Medusa* which was sent immediately to San Diego. The Destroyer Base was diverted from its customary routine of upkeep, and with personnel augmented from the flagship *Omaha*, the destroyers, and the fleet, was thrown into the active job of recommissioning. The crews of the tenders were augmented by specialized mechanics from the crews of the destroyers, and also by destroyer working parties and by additional men made available by the commander in chief, battle fleet. Later in the recommissioning period the *Omaha* took on many of the functions of a tender in addition to furnishing men to other activities.

The forces outside of the destroyers as finally mobilized for the recommissioning program consisted of the U.S.S. *Melville*, the U.S.S. *Altair*, the Destroyer Base, the U.S.S. *Medusa*, and the U.S.S. *Omaha*.

The Navy Department in announcing its decision for the forces afloat to carry out the recommissioning program allocated the replacement squadrons. The Sixth Squadron in reserve was assigned to replace the Eleventh Squadron and the Tenth to replace the Twelfth. Once the decision was known, action by the forces afloat proceeded rapidly along lines which had been planned in anticipation of the department's decision. The first step was to assign each vessel of the old squadrons a new mate from the new squadrons and to pair one old with one new for recommissioning.

With the pairings announced, the next step was to separate the thirty-four selected ships from the seventy-eight at the Destroyer Base and place them with their mates where the work could be most expeditiously begun. Some were to go alongside the tenders to begin the recommissioning operation while other pairs were to remain at the buoys for ship's work while awaiting their turn at the tender. In order to save time the decision was made for each old destroyer to proceed to the Destroyer Base and to tow its new mate to its assigned location. There was a touch of pathos when on September 21, 1929, the first two destroyers, clean and immaculate, paintwork new and bright work shining, unmoored and under their own steam got under way for the four mile trip to the Destroyer Base. There they were to get their mates out of the graveyard and transfer all that was good to them before being put themselves on the dump for disposition and sale. Off the Destroyer Base the active destroyer went

alongside her new mate and took her in tow. The contrast between the two vessels was most marked. The active destroyer, a ship-shape man-of-war, with commission pennant flying, was a thing of beauty. The new mate from reserve was dirty and unkempt, spotted like a leopard with daubs of red lead, paint cracked, faded, and weathered by years of the action of the elements, a dejected-appearing ship seemingly without hope or future aspirations.

The unfavorable impressions of the reserve ships later proved to be largely unwarranted. While the external appearance was distinctly gloomy, there was but little corrosion within. Below decks, the ships were clean and dry and in an excellent state of preservation; much the same as when they had been placed out of commission. All compartments had been habitually kept closed; pans of unslaked lime in the compartments, renewed at intervals, had removed moisture from the air and retarded corrosive action, but much of the preservative employed in the machinery required many hours of labor to remove.

The routine upkeep of ordnance and engineering materials had kept these parts in much the same condition as when the ships had been decommissioned. A few defects of generally infrequent occurrence later revealed themselves during the recommissioning period. In most cases they were probably present when the vessels were put out of commission. Some typical defects were defective condensers; turbine blading damaged and turbine bearings so badly worn as to require extensive repairs; and reduction gears either out of alignment, or actually needing replacement.

One curious manifestation of nature's workings developed which had not been foreseen. During the years that the ships had been lying inactive, marine calcareous plants crept in from the sea into the small space between the propeller shafts and the bearings in which they revolve and left thin coatings of abrasive-like lime deposits on the composition journals. These deposits were first noted in the case of the *Badger* which developed a vibration during a trial run, which remained unexplainable until a second docking after running less than a thousand miles showed a wear of the strut bearings equal to about that produced in three years' normal operation. The homing instincts of the marine plant necessitated a second docking of every ship and the cleaning of every strut bearing, and in some cases, the renewal of the *lignum-vitae* bearings. Also, eleven of the ships assigned to the Sixth Squadron had a type of boiler built during the war in which the steam and water drums were butt welded. Subsequent experience had indicated the desirability of strengthening this type with riveted plates over the welds. This reënforcing was beyond the capacity of the forces afloat and was the major job accomplished in the navy yard. The necessity of sending these eleven ships to the yard for this work resulted in considerable inconvenience, and delayed their completion.

The remedying of defects found in the new ships, however, was but a small part of the work done. The main job was to take the reserve destroyers, install all modern improvements, and put them in first-class running condition, with a minimum of work to be done at the navy yard.

The problem of organizing for the work was a colossal one. How to turn men trained for operating ships into welders, molders, blacksmiths, coppersmiths, electricians, and machinists of ability within a minimum of time and make rapid progress on the whole job while so doing required vision and planning of high order.

To save time, jobs requiring the least skill and knowledge were begun at once. While the work was being started, the commander destroyer squadrons, and squadron commanders, listed the jobs and alterations to be accomplished and the priority in which they were to be undertaken. They were further divided into tender jobs and ship's force jobs. The tender jobs for construction and repair, and engineering were further subdivided into different priorities. It was also decided to give each vessel two tender overhauls. At the first overhaul all jobs necessary for safe operation under way were to be accomplished as well as such of lower priorities as time permitted. The remaining jobs were to be accomplished at the second overhaul. Engineering and construction and repair jobs were listed by numbers. Ordnance work to be accomplished was covered by numbered job orders which went into considerable detail. As an indication of the magnitude of the work in hand, it is of interest to note that the alterations and

repairs to be done by the forces afloat totaled approximately 8,000 items for the thirty-four vessels exclusive of items incident to cleaning and making the vessels shipshape.

One of the biggest alterations was the successful installation of the torpedo and gun fire-control wiring. It, like all the others, was conquered by vigorous concentrated effort and the instruction and supervision of unskilled men until they became skilled. After a few months, seamen, second class, were pulling wire and making electrical connections who previously had had no knowledge whatever of the work. A great many unskilled men in this and other jobs thus had an opportunity to satisfy the ambitions for which many of them had enlisted, that of learning a trade. Bureau of Navigation training courses were of much advantage in the combining of theory with practice.

The removal of 108 Dow pumps from six destroyers and their replacement by Worthington pumps was another alteration of major size. The bending and shaping of hundreds of feet of large copper pipe up to seven inches in diameter was another outstanding achievement.

The accomplishment of these alternations and all the others was made possible by a liberal application of the principle of "learning by doing" which became a watchword during the recommissioning program. Under this policy seamen, second class, and firemen, third class, were doing all manner of things after the work had been under way for a few months, accomplishments which formerly had been the exclusive prerogatives of petty officers. Petty officers and officers likewise measured up to enlarged responsibilities.

The full display of initiative of the officers and men was developed. Ships were encouraged to undertake every job they possibly could to relieve the load from the tenders. The use of unskilled men from the destroyers under the guidance of tender petty officers was frequent. Instruction of officers and men in connection with the wiring installation was held in advance of the receipt of wire and material, ordered from navy yards all over the United States.

The ships responded energetically to the call for initiative. Jobs were accomplished which had hitherto been considered impossible. In fact, some jobs that at first were considered beyond the capacity of the tenders ultimately were found to be within the capacity of the destroyer personnel, themselves. As a consequence, the expression "beyond the capacity of the forces afloat" has taken on a new meaning. Lack of welding equipment was the neck of one bottle which held up much other work. On one ship an electric welder was devised in which a searchlight rheostat was used for resistance, and a pair of insulated pliers was used for holding the welding rod. A description of this device was broadcasted and it was used elsewhere with considerable success for other than strength welding.

It was found that fire-control instruments would be disconnected for some time and a warming device to energize the instruments was needed. A fire controlman, first class, developed a simple device which met all the needs, and ships were informed. Other instances of initiative occurred, too numerous to mention, all of which contributed toward the completion of the big job.

A rather amusing instance of initiative happened on one ship on which an enlisted man of an engineer rating had the misfortune to suffer one of the infrequent injuries which occurred. His right arm was hurt while at work. After the doctor had given him treatment and put the arm in a sling the man was sent up on deck as the ship was so cluttered up and busy with work below decks there was no room for him there. Later, on deck, the man volunteered to stand gangway watch, because as he said, he was perfectly able to carry messages with one hand even if he did not know much about deck watches. His desire to serve permitted an able bodied man to be relieved and put on useful work. Shortly after this the admiral came on board and received a left-handed salute.

"What's this! What's this!" he said to the commanding officer, "Are you working the cripples, too!"

For several months each commanding officer had two ships under his command. Having two ships thus under one commanding officer gave the same injured engineer a problem which he solved in his own way. The old ship happened to be on one side of a tender and the new one on the other. The injured engineer was still on watch when the commanding officer temporarily

left his old ship, still in commission, to go to the new ship. The engineer was nonplused what to do with the captain's absentee pennant. The problem was out of his usual line of work. The captain was off one ship but still he was on the other. He finally compromised and half masted the absentee pennant as being the best answer, since, as he said, "The captain was half gone anyway."

Safety of personnel through careful attention to details was emphasized. Security watches were established. The efficiency of the measures adopted is shown by the freedom from injuries. None resulted save of a minor nature except in one unusual accident where the evidence indicated that the hose to an acetylene tank was accidentally pulled loose while an operator was using a torch. The escaping gas ignited, inflicting injuries from which one seaman subsequently failed to recover.

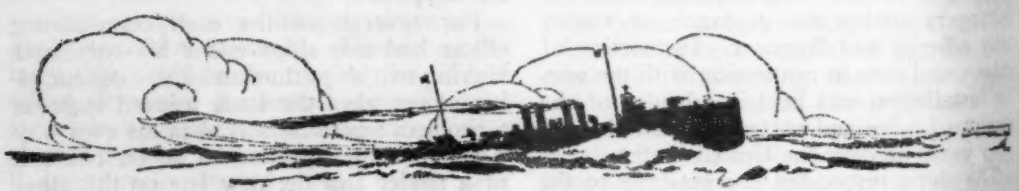
With the energetic work of all hands the reconditioning program proceeded rapidly. The first ship was commissioned on January 8, when amid appropriate ceremonies the ensign on the old ship was hauled down and the colors run up on her successor. Thereafter from time to time one reserve ship after another emerged from its chrysalis and spread its wings in the form of a commission pennant until on June 4 the last vessel was commissioned.

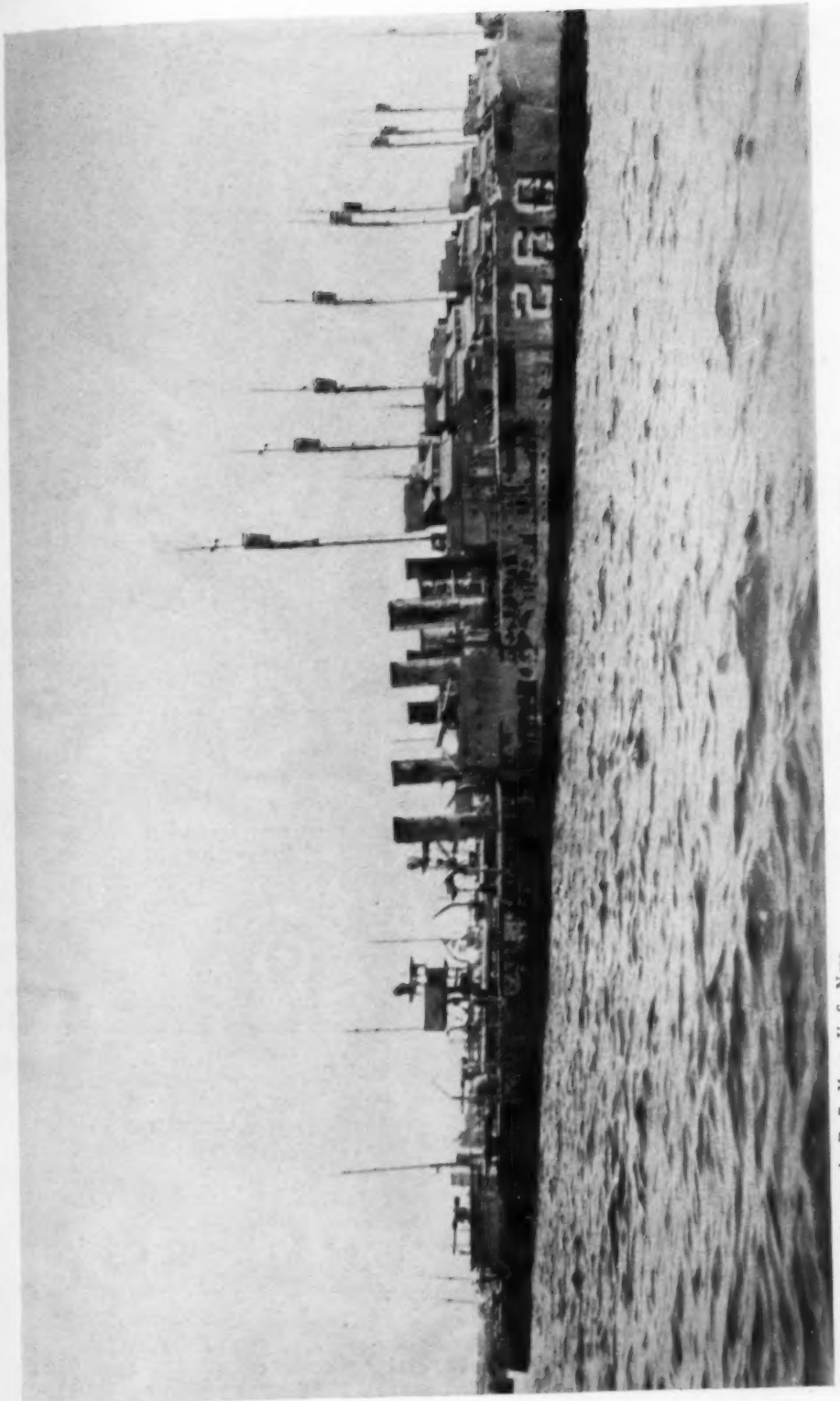
The work that has been done on these ships compares very favorably with that done in a navy yard. It has been done with much less additional charge to the Navy than if done in a navy yard. The work afloat, including navy yard work required, was accomplished within the allowance that had been made for the navy yard repairs of the old vessels for the current fiscal year.

Now, as the recommissioning program has reached its end, ships whose decks had not been trod since the war are preparing to outdo their predecessors. Disguised in their resplendent coats of paint and again trim and shipshape appearing one cannot detect the mangy-looking vessels that were towed from the Destroyer Base last fall.

To give credit for the successful accomplishment of the gigantic undertaking represented in the recommissioning program it would be necessary to list the name of every officer and man who took part in this work. They have all served with unusual energy, loyalty, and devotion.

Now that the recommissioning work is a memory, to those who have taken part in it will remain the remembrance of a new experience. It has been one broadening in its nature to the hundreds of officers and thousands of men who have participated. It has brought difficult problems which have been met enthusiastically and conquered. In overcoming them, non-rated men, petty officers, and officers have measured up to enlarged responsibilities. They have a new conception of what can be undertaken and successfully accomplished. This knowledge will be a perpetual source of inspiration to those having taken part, when in the future, some one says, "such and such can't be done." Then will be recounted the tale of what was done on the U.S.S. so and so at San Diego 1929-1930 during the recommissioning program of the destroyer squadrons, battle fleet, and how the Navy Department, as in the days of Macdonough, had decided wisely when the problem was placed in the hands of the fighting forces. The accomplishments of the destroyer squadrons in carrying through to a successful conclusion the modernization and recommissioning of the thirty-four vessels has added another page to the records of brilliant accomplishments which have ever characterized the American Navy.





Courtesy Lieutenant Commander D. P. Moon, U. S. Navy BEFORE THE RECOMMISSIONING WORK BEGAN

Courtesy Lieutenant Commander D. P. Moon, U. S. Navy

PREPARING STANDING RIGGING

Bunnell Photograph

Courtesy Lieutenant Commander D. P. Moon, U. S. Navy

PREPARING STANDING RIGGING

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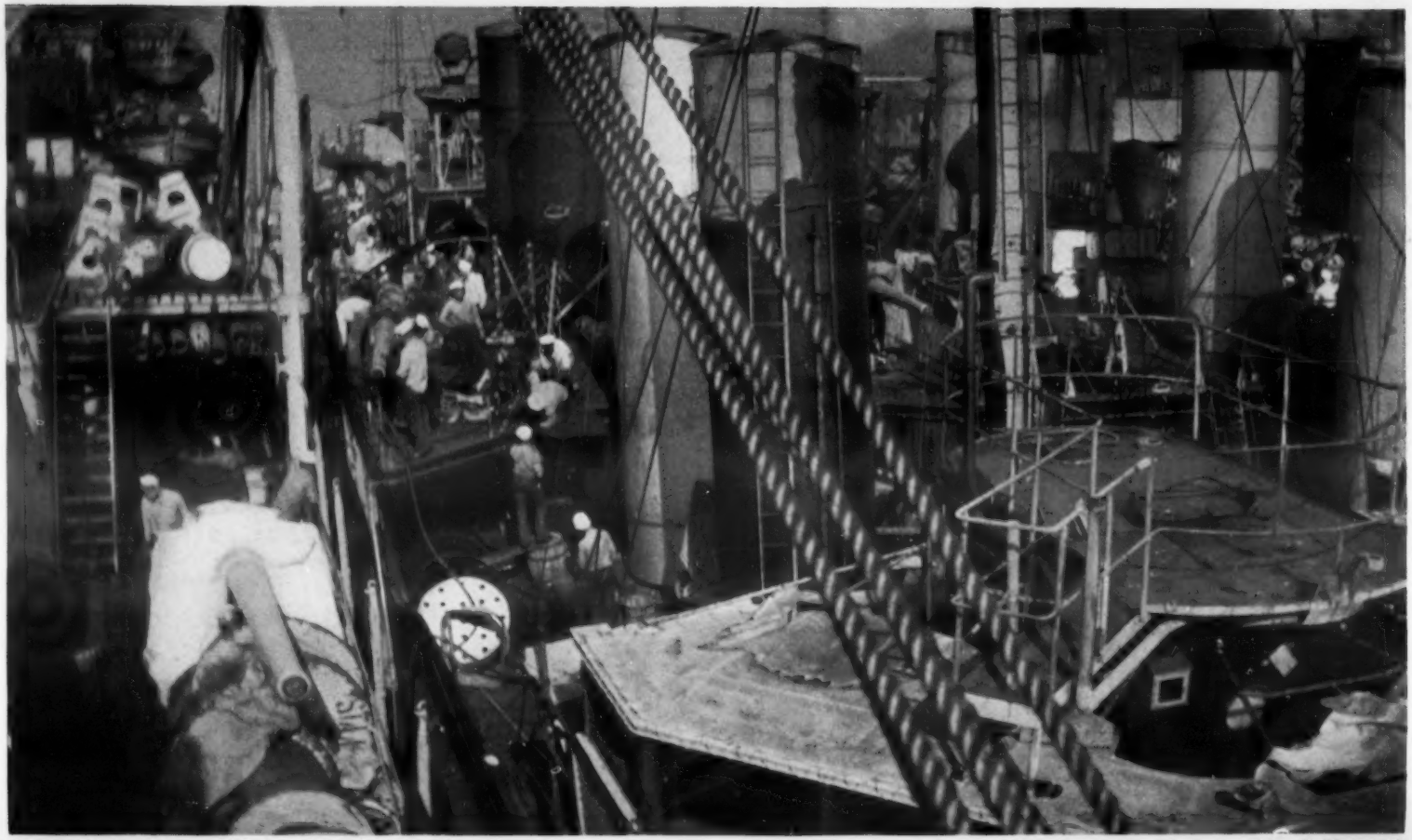
Courtesy Lieutenant Commander D. P. Moon, U. S. Navy

WELDING SCENE

Bunnell Photograph



Courtesy Lieutenant Commander D. P. Moon, U. S. Navy

ONE OF THE WORKING PARTIES

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ONE OF THE WORKING PARTIES

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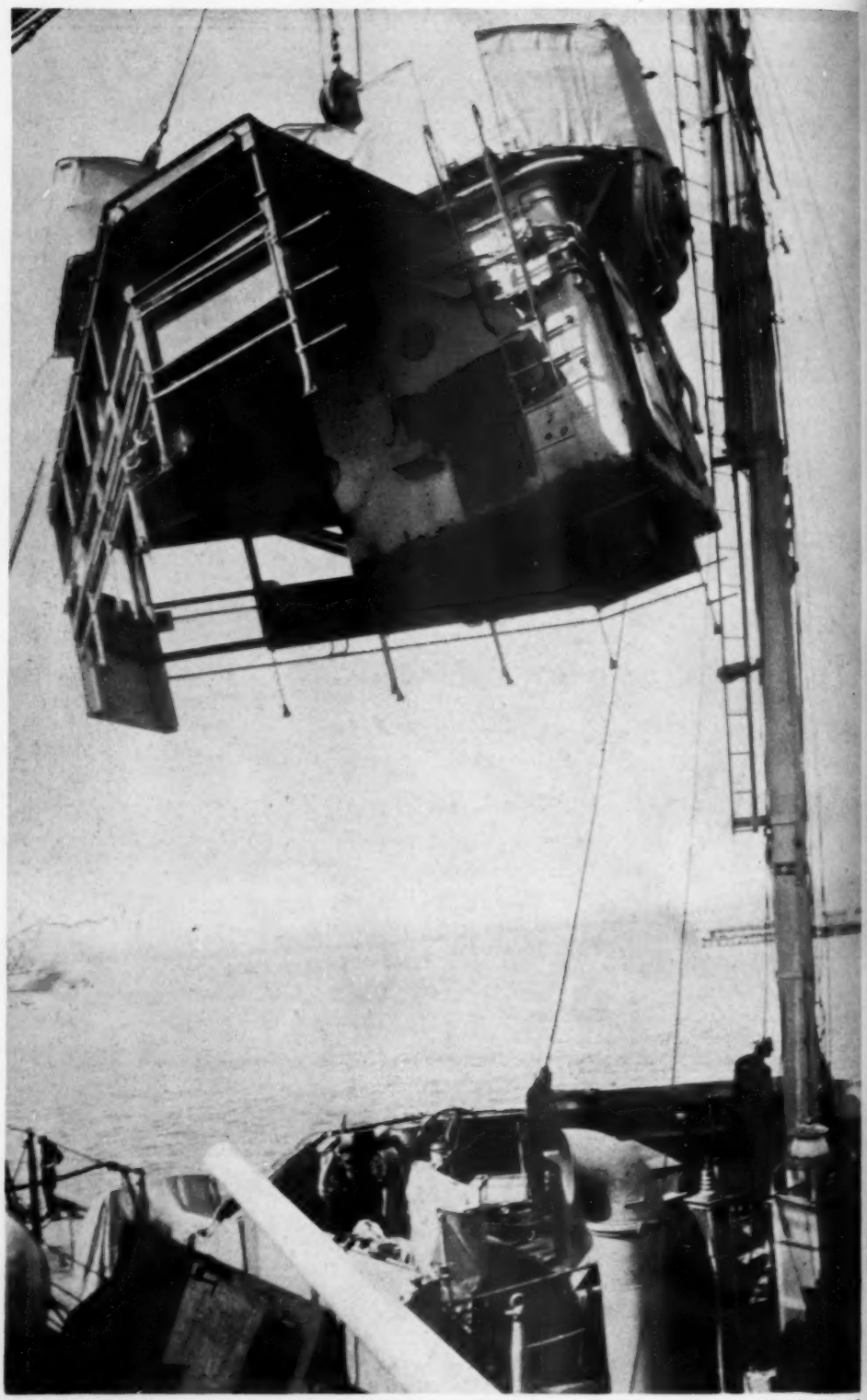
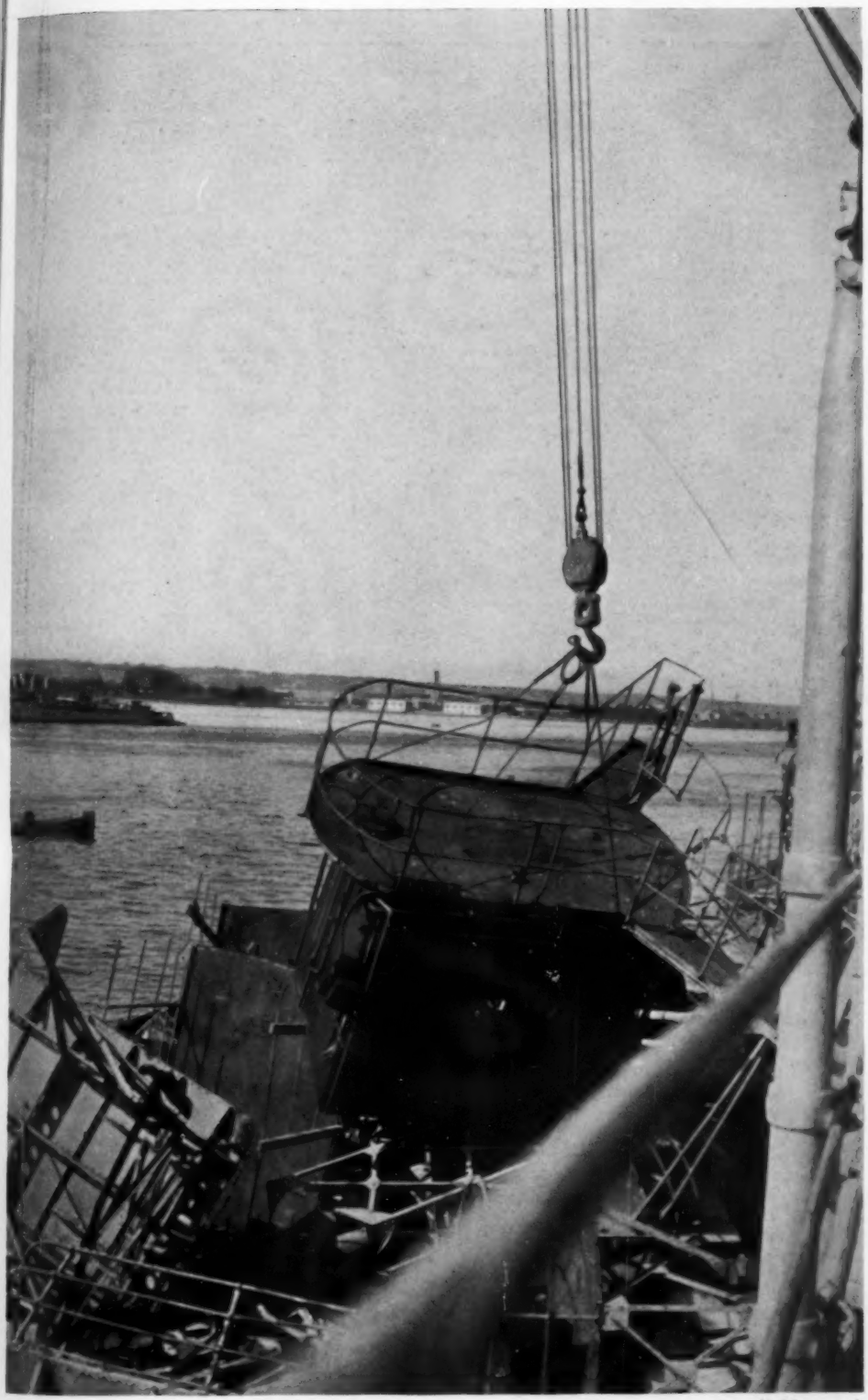
A LIGHTER OF JUNK REMOVED FROM RESERVE SHIPS BEING RECOMMISSIONED



Courtesy Lieutenant Commander D. P. Moon, U. S. Navy *Bunnell Photograph*

DESTROYER BRIDGE BEING SHIFTED BODILY



Courtesy Lieutenant Commander D. P. Moon, U. S. Navy *Bunnell Photograph*

PILING UP THE JUNK

PREPARING TO ATTACK

Courtesy Naval Records and Library, Navy Department

Courtesy Naval Records and Library, Navy Department

CHART FOR DETERMINING HEIGHT OF TIDE

By Frederick S. Dellenbaugh, Jr., Sc.D.

THE standard method of determining the height of tide at any period between successive times of high and low water consists of drawing a circle and dividing the circumference proportionately to the high water interval. The projection of these intervals on the diameter of the circle then gives the relative height of tide for the time chosen. This method is based upon the fact that for the period between successive high and low water points the motion of the tide may be assumed sinusoidal. It is of course well known that the tide may be expressed by Fourier's series, and the approximation involved above depends upon the fact that the particular harmonic value producing daily changes in tide predominates. Therefore, this approximation is satisfactory where a uniform tide is experienced, but will not hold where peculiar conditions prevail as with some islands in the Pacific, the Bay of Fundy, and the like.

The circumference of the circle must be divided up differently for each tide interval or else still further approximations must be involved by assuming an average interval.

Theory for square chart. The object of this article is to describe a different form of chart which may be universally used under the same approximations and limitations as hold for the circle. The chart consists of two Z-type alignment charts placed together forming a square with a common diagonal. The scales are based upon the following relation:

Chart for determining height of tide.

$$h = \frac{R}{2}\left(1 \pm \cos\frac{t\pi}{D}\right)$$

Where: t = Hours elapsed since last high or low tide.
D = Tide interval.
R = Range of tide.
h = Height of tide at the time t.

The sign is plus for ebb and minus for flood tides. These values are shown graphically in Fig. 1.

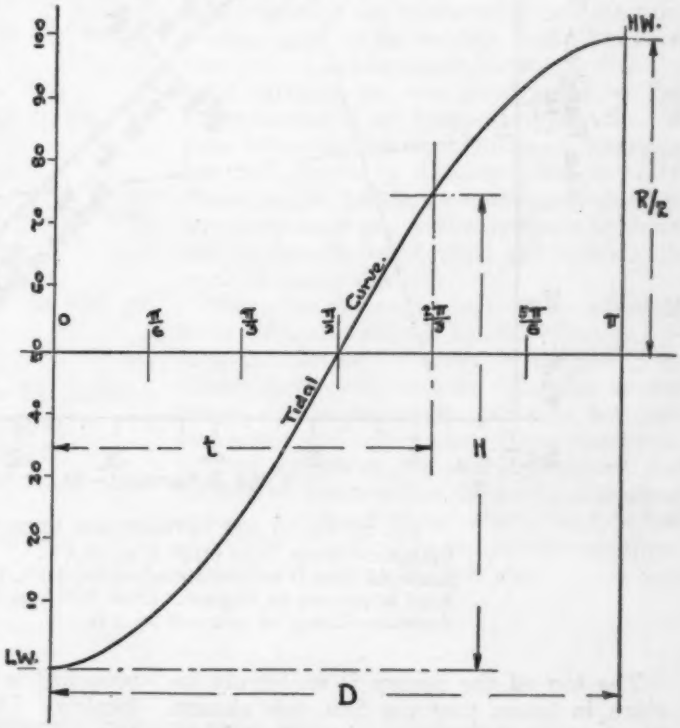


FIG. 1. APPROXIMATE TIDAL MOTION FROM LOW TO HIGH WATER. Defining symbols used in chart.

Construction of square chart. In the main chart the left-hand edge of the square is divided uniformly in values giving range of tide in feet. The right hand edge of the square is divided uniformly in values of height above the last low water, or distance below the last high water. In other words, this edge of the square gives the change in height of water from the first slack water tide chosen.

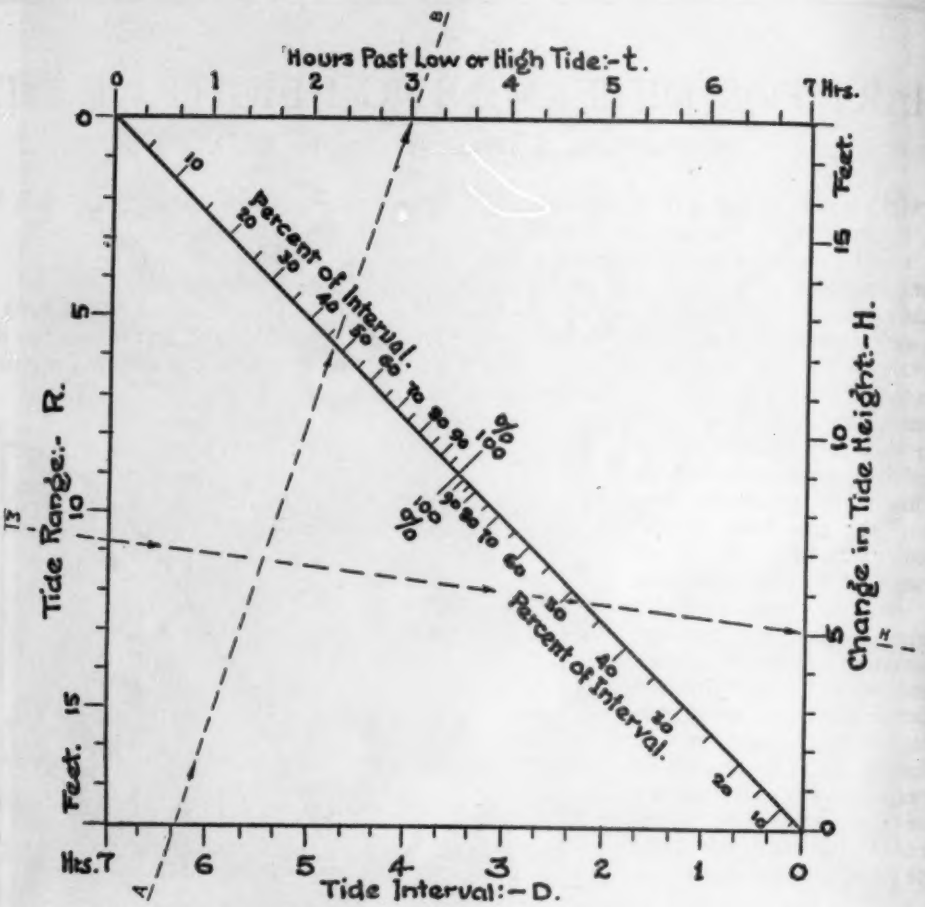

Hours Past Low or High Tide:-t.
0 1 2 3 4 5 6 7 Hrs.
Tide Range:- R.
Feet.
Percent of Interval.
10 20 30 40 50 60 70 80 90 100 %
Change in Tide Height:-H.
Feet.
Hrs. 7 6 5 4 3 2 1 0
Tide Interval:-D.

FIG. 2. CHART FOR DETERMINING HEIGHT OF TIDE
Example:—Given $D = 6^h16^m$ $R = 10.8$ ft.
Draw *AB* from *D* to time desired—, i.e., 3 hrs. here.
Read 48 per cent on diagonal. Draw *MN* from *R* through 48 per cent.
Answer:—Change of tide:—$H = 5$ ft.

The top of the square is uniformly divided in hours past the first tide chosen. The bottom of the square is uniformly divided in values giving the interval between low water and high water or the reverse.

The upper part of the diagonal is divided in a non-linear manner so that it relates the time elapsed to the tide interval reading in per cent. The lower half of the diagonal repeats these same percentage figures spaced in accordance with a special function scale so that it relates the height of tide h to the range in accordance with the formula above.

Method of use. To use this chart the time for the low- or high-water period just past and the high- or low-water period being approached is taken from tide tables for the locality. The range of tide between these two values is also noted. The time at which knowledge of the height of tide is desired is then expressed as hours and minutes past the previous time of slack water. A ruler or any straight line is then drawn through the elapsed time on the top of the chart to the interval at the bottom of the chart and the per cent of interval elapsed noted on the diagonal. The straight edge or line is then moved to the range on the left-hand side of the chart so that it passes through the same per cent of elapsed interval upon the lower half of the diagonal. Its intersection with the right-hand side of the chart then gives

the change in height of tide from the reference value chosen.

Example 1. The tide at Boston August 15, 1928, gave the following values:

Low tide 4h 37m A.M. — 1.2 ft.
High tide 10h 53m A.M. + 9.6 ft.
D = 6h 16m R = 10.8 ft.

A. What will tide be at 7h 37m A.M.?
t = 3h 0m
$\%D$ = .48 h = 5 ft.
Answer.—5 ft. above low water or 5—1.2 = 3.8 ft. above mean low water.

B. When will tide = mean low water, i.e., h = 1.2?
$\%D$ = 0.21 t = 1h 20m
Answer. Mean low water at 4h 37m + 1h 20m = 5h 57m.

C. When will tide give 6 ft. above mean low water, i.e., h = 6 + 1.2 = 7.2?
$\%D$ = 0.6 t = 3h 45m
Answer. 6 ft. at 4h 37m + 3h 45m = 8h 22m.

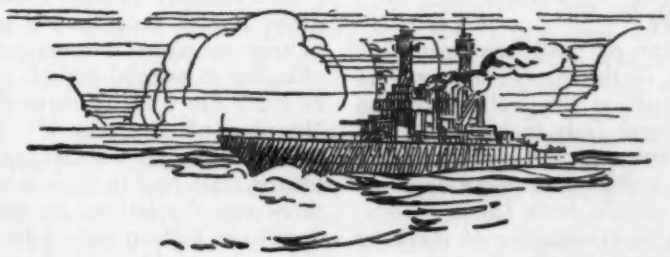
Example 2. Boston, October 24, 1928.
High tide 7h 08m A.M. + 7.9 ft.
Low tide 1h 14m P.M. + 1.5 ft.
D = 6h 06m R = 6.4 ft.

A. What will tide be at 11h 08m A.M.?
t = 4h 0m $\%D$ = 0.65 h = 4.6 ft.
Answer. 4.6 ft. below high water
= 3.3 ft. above low water
+ 1.5
4.8 ft. above mean low water

B. When will tide give 6 ft. above mean low water?
6 ft. above mean low water = 4.5 ft. above low water = 1.9 ft. below high water.
$\%D$ = .36 t = 2h 15m
Answer. 7h 08m + 2h 15m = 9h 23m A.M.

NOTE: The chart has dotted lines showing values for Example 1A. The accuracy will vary with the characteristic of the tide, configuration of the locality, and other such features. For large open harbors where the tidal currents are not constrained by the configuration of the bottom and for times of year when successive high-water intervals are not materially different, the accuracy should be quite high, the errors probably being of the same order of magnitude as those due to the effects of wind and other such variable conditions.

When the successive high-water intervals have different values it has the effect of tipping the axis of the curve shown in Fig. 1. Under these conditions the error due to this cause will be minimum half way between low water and high water. Since exact values are known at low and high water, the method of construction therefore minimizes error. As stated above where the tide for particular reasons does not follow a uniform curve the chart is not applicable.



ANNIE DALY—NAVY BUMBOAT WOMAN

By Chief Pharmacist Walter H. MacWilliams, U. S. Navy

MANY customs and traditions of Navy life existing up to the beginning of the current century are little known in the present-day Navy. During the eighties and nineties, wooden ships were being replaced by ships of steel and steam, and the transition from canvas to propeller brought many changes in life on board ship.

Until shortly after the Spanish-American War one feature of life in the Navy that contributed toward the contentment and welfare of the enlisted men, was the the bumboat. There is no question of the value and efficiency of the present canteen and ship's service store, but it can hardly be said that they mean as much to the men, as did the bumboat in those earlier days.

Each ship had its bumboat, owned and operated by either a man or woman; sometimes, by both. The bumboats followed the ships from port to port along the Atlantic coast. Often the first familiar face seen in the new port was that of the bumboat man or bumboat woman, as their boat was being rowed (sometimes for long distances) to the ship's anchorage.

One of the most famous and best liked operators of a bumboat was a woman, Annie Daly, who bumboated for the old *New York* (later the *Saratoga*, and now the *Rochester*), from the time that ship was placed in commission in 1893, until bumboating was prohibited in 1899.

Many an officer or man has spent his entire active life in the Navy, and yet has not added as much to the welfare of the service as did Annie Daly in her contributions to the contentment and morale of the men of the *New York*. Her name deserves a place in naval annals, both for her work, and as a worthy representative of the long existent professional bumboat man—now only a fast fading tradition.

Annie Daly, a native of Brooklyn, grew up around York and Sand Streets, near the Sand Street entrance to the Brooklyn Navy Yard. It is said that she had been married to a bluejacket who died before she began bumboating for the *New York*. At that time she was a fine looking widow of about thirty, who dressed well and attractively. Hers was a pleasant personality, and she had the appearance of a successful business woman, rather than that of a bumboat woman—although she was a great success in her chosen field of activity. One of the best estimates which can be made of her, is the regard in which she was held by the men of the *New York*, whom she served. Next to the members of their families, there was no woman they loved more than Annie Daly. On the other hand there were few women who would do more for them than Annie Daly. When they were in trouble, she was their friend. It they needed money quickly, Annie loaned it to them; and it is said that there was no knowledge of any man defrauding her. It would not have been well for him, had the crew found it out.

"Class liberty" was then in effect; fortunately it does not obtain today. There were six liberty classes: special first class, with liberty every other day; first class, with liberty every fourth day; second class, with liberty once a week; third class, with liberty once every fortnight; fourth class, with liberty once a month; and special fourth class with liberty once in three months.

The sentence at mast always carried with it the liberty class, and a court-martial or a brig sentence automatically placed the offender in special fourth class. One had to work his way up through each class by "keeping off the report." Thus it can be seen that a man who was placed in special fourth class had to have a clean record for three months before he could go ashore; then have a clean record for another month before he could make another liberty, and so on until he became first class. Special first class was difficult of attainment, because a man had to have a clear record for one year to reach that desirable status.

There were men who made the famous cruise around the world in 1907-09 with but few liberties, because they were "classed," and again committed themselves before their liberty day was reached. A regulation existed that a man could not be kept on board for more than six months without liberty. In addition to the above, a man could only draw the fraction of his monthly pay represented by his class of liberty; for example, a third-class man could only draw one-third of a month's pay on pay day.

To such men Annie Daly was a godsend. She would make purchases for them ashore (charging them only the shore price), do errands for them, lend them money, or sell to them on credit until they received money to repay her.

Her stock was the same as that of most bumboat men: pies, cakes, candies, pipes, tobaccos, fruits in season, and anything else for which there was a demand.

The only other source of pies and cakes on board was the ship's cook's slop chest. In those days the general messing system, as it is known today, was not in effect. The various divisions of the ship messed independently, with a man known as a "berth deck cook" assigned to each mess. He drew the rations and prepared them for cooking, while the ship's cook was in charge of the galley and supervised the cooking of the food brought there. The paymaster issued three-fourths of the ration in kind, and one-fourth in money. The latter was used to purchase extras. The jack-of-the-dust served out the commissary stores to the berth deck cook according to the number of men in the mess. But when it came to issuing lard and flour, he often served them short. And with the lard and flour gained in this way, he colluded with the ship's cook, who used it in making pies and cakes which were sold to the crew. Of course, the returns from this lucrative business went to the operators.

The main article of sale in the bumboat stock, and the one most desired by the bluejackets, was not eatables nor smokables but beer. While spirituous drinks, such as the grog of the olden days, were no longer served, yet beer was sold to the men on board ship. And beer only. Even the officers' wine messes were permitted to carry and serve only light wines and beer. If liqueurs, brandies, whiskeys, and other drinks of high alcoholic content, were carried in the officers' wine messes it was done surreptitiously and these liquids were always billed, inventoried, and reported as "cooking sherry," "sea sherry," etc.

The beer was sold in bottles for five cents a bottle, but beer checks could be purchased at the rate of six for a quarter. The bottles had patent stoppers and had to be returned to the bumboat man who took them ashore for refilling. The beer was usually warm, but it was beer, and the men would rather have it warm, than not at all.

No ship permitted more than three bottles of beer to be sold to a man at one time; most ships, two bottles; and some, only one bottle. The only time that beer was sold more than twice daily was during coaling. Then, all hands were knocked-off and work delayed for fifteen minutes at ten-thirty and three o'clock to "splice the main brace."

The chief master-at-arms, together with his assistants, saw that no more beer was purchased than the ship's regulations allowed. The only way to beat the game, was for nondrinkers to buy their allowance, then later sell it to drinkers. But even that was risky business, for the master-at-arms had sharp eyes; then, too, the teetotalers were a very small minority.

As liquor detectors, the masters-at-arms of those days were without peers. Cornelius "Con" Moran, chief master-at-arms of the *New York*, was said to be able to "smell liquor a mile away."

The chief master-at-arms was the leading chief petty officer on board. The selection of the bumboat man of a ship largely rested with him, because it was on his recommendation, approved by the executive officer, that the captain issued the bumboating privilege. Hence it was necessary to "stand in" with the "jimmy-legs" as he was called, and not break or aid in breaking the ship's rules, if the bumboat privilege was to be retained.

Further, part of the brig was needed for stowing beer, and the chief master-at-arms was master of the brig.

Thirty-five to forty cases of beer, twenty-four bottles to the case, were frequently sold to the crew of the *New York* when the bumboat man was on board.

Usually two daily trips were made by the bumboat, after the noon meal, and after supper. Such trips were made by pulling boat and very frequently in rough water.

Often the bumboat stock, including the beer, was kept in the ship's brig under lock and key, between visits. While the ship was under way between ports on the Atlantic coast, the bumboat stock was also often locked in the brig. At times sales were made at sea by assistants on board, but with a strict accounting made in the presence of the chief master-at-arms, when the bumboat man was again met up with.

Thus, a bumboat man needed assistants on board who were members of the crew. These were not hard to find, because they received free beer. Annie Daly later married her chief lieutenant and assistant on the *New York*.

Annie's assistants on board always had her address while the ship was away on a cruise. If anything was wanted from the United States by men on board, it was only necessary to write to her. She would make the desired purchase, and forward the articles without any additional cost. Men might have been glad to pay additional for the many extra services and favors she performed for them, but she made it a rule to receive only the profit from her sales.

Like most bumboaters in those days, Annie Daly carried on a legitimate business, and it was impossible to get her to smuggle anything which was not permitted on board. The only liquor sold was beer, and if "classed" or other men wanted anything stronger to drink, they had to get it from the boat coxswains, who were reputed to be past masters in the art of smuggling liquor. There were too many other persons looking for the privilege of bumboating for a bumboat man to knowingly break the rules laid down by the executive officer or the master-at-arms.

Annie Daly was the friend of any Navy man in need, and like a true friend, she did not publish her many kindnesses. If they became known, it was always through the recipients. Nothing seemed to be too much trouble or bother for her to do for the men, especially if they were "classed" and had to remain on board. She was impartial in her dealings and showed no favoritism, all men were alike to her if they needed help. And a debt to Annie Daly was a debt of honor.

She was a splendid, generous-hearted woman. The crew of the old *New York* held her in the highest regard, and to this day have pleasant recollections of her and her deeds.

BUY—DON'T BE SOLD—INSURANCE

By Rear Admiral Elliot Snow (C.C.), U. S. Navy (Retired)

THE year 1929, which marked the fiftieth anniversary of the Navy Mutual Aid Association, proved to be a banner year in more senses than one. It was attended with great financial success and large increase in members, and 1930 may show even better results.

During the half century just past, the Navy Mutual Aid Association has proven itself to be a staunch "anchor to windward" in many threatened naval family disasters. At the outset, this benevolent organization, created by, and for, the sole benefit of the officers of the Navy and Marine Corps, an unsound assumption was made as to the probability of life—or differently stated; its founders possibly did not understand actuarial principles, or at least did not take into account the increased chance of death as one grows older. An examination of Fig. 1 entitled "The Probability of Life Curves," which are based upon the American Experience Mortality Table, will make clear the fact that the allotted time of man is not always seventy years.[1]

How to ascertain from these curves the expectation of life, or its inverse the chance of death, is explained by the text accompanying the figure. The examples chosen to elucidate the curves do not understate the predictions of insurance companies where large numbers are concerned. An individual, of course, knows absolutely nothing as to his or her prospective longevity, but when buying insurance should assume a length of life equal to the average shown by these curves.

Endowment Policies. Although a level line has been drawn on Fig. 1 to indicate an age limit beyond which no one ought to consider buying an endowment policy, with a fifty-fifty average chance of its maturing during one's lifetime, the following observation should be borne in mind by all readers.

After mature reflection, the author concludes that twenty-year endowment policies are not generally suited to the needs of the average naval officer with a family to protect. Officers should aim first at complete protection for their families by creating an adequate potential estate and not attempt to invest money in life insurance. Life insurance as an investment is a very poor-paying proposition in the long run. As a means of saving it cannot be excelled.

Yet twenty-year endowment policies do have a distinct place in the economic life of our nation for some individuals. They are of value to spendthrifts, for example, who through the purchase of such policies are forced into making a saving which they really can afford.

For a young naval officer about twenty-five years of age, an endowment at age sixty-five policy, is to all intents and purposes a whole life policy because the average future life at that age is but thirty-nine years.

Again an endowment at age eighty-five policy is virtually a whole life policy as far as cost is involved. Such a policy can be had at age fifty-five (for $5,000) on a monthly premium basis of slightly less than $24 a month. While a whole life policy at that same insuring age of fifty-five will cost, on an annual premium basis, about $237. The essential difference between the two is that the whole life policy calls for large payments on an annual premium basis, the

[1] The poignant and melancholy pronouncement, "allotted time of a man is but three score years and ten" has in all likelihood been the innocent cause of many prospects saying "no" to perfectly sincere and ethically sound insurance solicitations. Seventy years are not allotted to every man. If the young of each generation could but realize the probability that seventy years will not be their term of life, and knew the values of life insurance, they would buy it without having to be sold insurance. The loading (or overhead) element of cost would drop but not the mortality charge which is the same in all sound insurance companies in the United States and Canada. The mortality experience of the Navy Mutual Aid Association is somewhere about 70 per cent of the American Experience table. Some commercial companies run even lower.

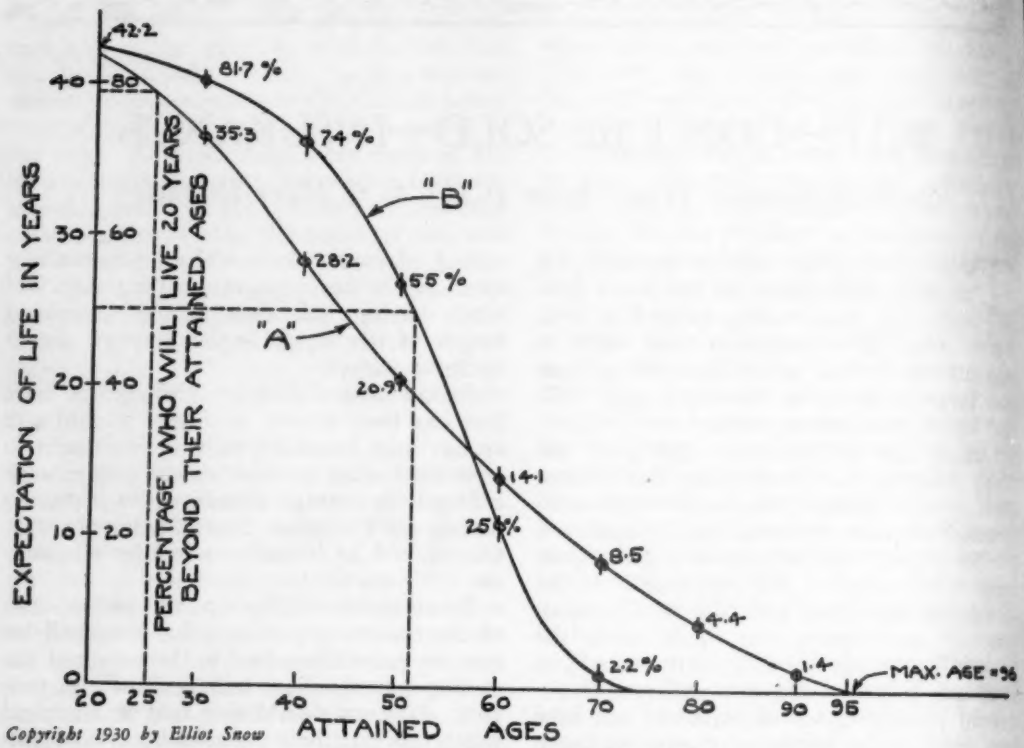


FIG. 1. PROBABILITY OF LIFE CURVES

Curve "A" = Expectation of life in years.

Curve "B" = Percentage who will live twenty years more. American Experience Table of Mortality.

To ascertain the "expectation of life" i.e., the average future life of an individual (as for example at age twenty-five), and the percentage of those then living of that attained age (of ordinary risk) who will live twenty years more, proceed as follows:

Locate the attained age on the axis of abcissæ—attained age axis—at that point erect a perpendicular. The heights above the age axis, measured by the scales on the left side of the figure, where the perpendicular intersects curves *A* and *B* will give the desired data.

The dotted line drawn at 50 per cent shows that an ordinary risk who buys a twenty-year endowment policy when he is slightly over fifty-one years of age can scarcely expect himself to enjoy the fruits of his savings.

endowment at eighty-five policy calls for small payments on a monthly premium basis.

The very serious and erroneous basis on which the Navy Mutual Aid Association was founded, was fortunately corrected many years ago. So that today there is no other benevolent assessment society throughout the whole United States that can point with greater pride to its achievements, nor state with more assurance, that it is the equal to the very best and that it offers the soundest, safest, and least expensive insurance of its kind to be had anywhere by members and eligibles.

The death benefit paid by the Association has risen to $7,500 in the short space of five years (from $5,000 in 1924) without change in the unit assessment, or increase in the standard annual number of assessments. The cost per $1,000 of insurance per year, for new members of the age of thirty-five (the upper age limit of admission to the Association) has dropped from $9.55 to $5.60 during the last five years, notwithstanding the heavy aviation mortality during that period.

Years ago when the author joined the Association, the benefit was about $3,500. Today without any apparent increased cost to himself, the benefit is now $7,500.[2] With his present expectation of life of sixteen

[2] By "apparent" is meant, not felt financially; because when one pays by allotment the deduction from one's pay is soon not felt.

years, (but holding no illusions as to the certainty of living that long) the author expects to see this benefit reach, if not pass, the $10,000 mark. This is not a prophecy—it is simply a hope based on faith in the Association's future. If the Navy Mutual Aid by-laws permitted he would gladly double his payments to cover a double benefit. The two following tables will show the reason for this last statement.

TABLE I

Comparative cost per $1,000 per year in the Navy Mutual Aid Association and a large private mutual company.

Age	*Navy Mutual Aid Association present cost of insurance per $1,000 per year (1929)*	*$1,000 whole life in a commercial private company "A"*	
		Av. cost allowing for dividends	Cash value end of 20 yrs.
20	$ 3.61	$10.32	$175.00
25	4.17	11.80	213.00
30	4.81	13.73	259.00
35	5.60	16.26	311.00
40	6.63	19.65	357.00
45	7.95	24.24	427.00
50	9.68	30.30	485.00
55	12.26	38.69	540.00

NOTE: The figures for company "A", here given, are reduced to the basis of $1,000 per year. The policies were written for $5,000 and the dividends were actually paid to the policyholders.

In connection with Table I it should be borne in mind that if, at the end of this twenty-year period, the assurant desired to surrender his policy in Company A for cash, and thereby lose the protection for his family, he could do so and receive the amounts stated in the last column. Equivalent action on the part of a member of the Navy Mutual Aid would result in the return of the advance assessments to his credit and his pro rata share of the reserve which is accumulating each year because the actual costs in the table are only about one-half of the total assessments.

The Three Elements of Life Insurance Premiums—The three elements entering into the establishment of every life premium are: (a) The mortality charge, (b) interest on which reserve is figured, (c) the loading charge. The mortality charge made by all insurance companies using the American Experience Table is the same for all. The

TABLE II

Showing cost, savings, and equivalent dividends per $1,000 insurance in Navy Mutual Aid for the calendar year 1929 according to assessment age of members.

Age	*Actual cost per year per $1,000*	*Total saving**	*Equivalent dividends per $1,000*
20	$ 3.61	$ 28.29	$ 3.77
25	4.17	32.66	4.35
30	4.81	37.72	5.03
35	5.60	43.93	5.85
40	6.63	51.98	6.93
45	7.95	62.33	8.31
50	9.68	75.90	10.12
55	12.26	96.14	12.82
60	16.13	126.50	16.87
65	17.75	139.15	18.55

* As death assessments are on a natural premium basis, the older a member becomes the greater is his saving each year.

interest, upon which the legal reserve is figured, varies but runs usually from 3 to 3½ per cent compounded annually. The loading charge (commonly called overhead) varies with the skill and business ability with which the company is administered, that is, it depends upon the company's experience.

At this point, the reader is asked to study for a few moments Fig. 2 which compares graphically the mortality rate ratios of the American Experience with the assessment rate ratios adopted for the Navy Mutual Aid, the basis of this graph being the following table.

TABLE III

Mortality rate ratios and assessment rate ratios.

Age	*Mortality rate ratios Amer. Exp. Table*	*Assessment rate ratios N.M.A.A.*
20	$1.00	$1.00
25	1.03	1.15
30	1.08	1.33
35	1.14	1.55
40	1.25	1.84
45	1.43	2.20
50	1.76	2.68
55	2.37	3.64
60	3.42	4.46
62	4.01	4.91
Average	$1.64	$2.24

The average of a single assessment for all ages (twenty to sixty-two) in the Navy Mutual Aid Association is $2.76. Since the lowest assessment is $1.23 (at age twenty), and as unity is assumed for that age in the

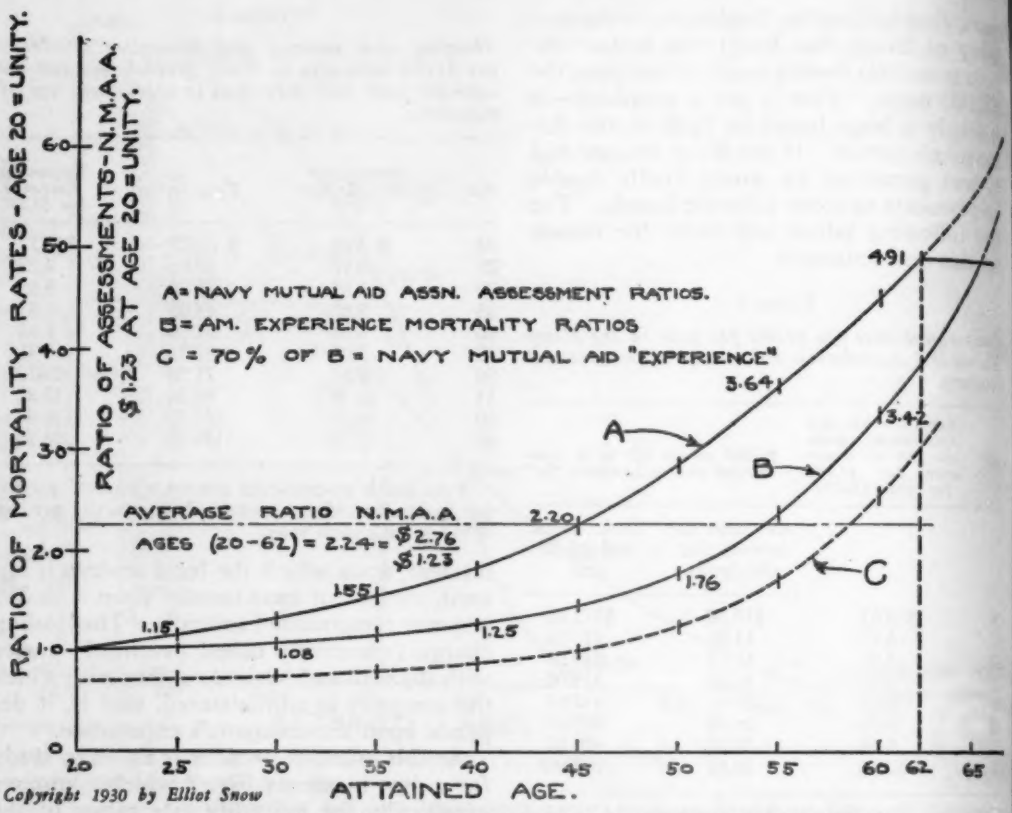


FIG. 2. MORTALITY RATES RATIOS AND N.M.A.A. ASSESSMENT RATE RATIOS

The average assessment in the Navy Mutual Aid Association between the ages of twenty and sixty-two is $2.76. In curve *A* $1.23 (the lowest assessment unit is taken as unity, hence $2.76/$1.23 = 2.24).

Since the mortality experience of the Navy Mutual Aid Association is only about 70 per cent of the American Experience Table, curve *B*, the intercepts on any ordinate between curves *A* and *C* show the large "factor of safety" under which the Navy Mutual Aid is operated. It is owing to this that the members' savings are so large and that a large reserve is being rapidly built up.

Using the Naval Mutual Aid Association experience of 1929 as a basis, an officer joining the association at age thirty-five will have accumulated in twenty years a reserve of about $1,365 in addition to the death benefit, and each year's saving is earning interest at the rate of 3½ per cent compounded annually.

The total additional savings of a member joining at age twenty and wishing to use it himself upon retiring at age sixty-four, is about $5,900—a tidy sum.

table, the corresponding average mortality rate ratio provided for in the Navy Mutual Aid can be arrived at by simple division, i.e., $2.76/1.23 = 2.24, which checks with the figure given in Table III.

This, it will be seen, is well on the safe side of the American Experience Table. It is even safer from an actuarial standpoint because the actual experience of the Navy Mutual Aid is only about 70 per cent of the American Experience Table.

During the calendar year 1928 the percentage of actual to expected mortality, in three very large mutual companies, ran uniformly about 59 per cent. This percentage is for ordinary risks and is low because of the great care exercised in scrutinizing the medical records and life histories of their applicants.

The effect of the second element entering into the premium, viz., the rate of interest upon which the reserve is calculated, becomes the more easily understood if one but stops to reflect upon the fact that premiums are required to be paid in advance (and hence commence at once to accumulate by the magic processes of compound interest). Whereas for purposes of calculations, the face values of policies which mature are paid (theoretically only) at the end of an inter-

est-bearing period. Thus all companies conducting their business on the American Experience Tables and using the same rate of interest, charge identically the same net annual premiums. The lower the rate the higher the net annual premium. The difference between net premiums, at different rates of interest, is accounted for solely by the fact that to produce $1.00 payable, say twenty years hence, by depositing periodically small sums which draw 3½ per cent compound interest does not require one to pay as much in advance each year as would be the case at 3 per cent interest. The amounts of money that must be invested every year for a stated period (say twenty years) to amount to $1,000 at the end of that period of years at various rates of compound interest are these:

Rate of interest.....	3½%	4%	4½%
Annual deposit	$34.17	$32.29	$30.50

premiums (i.e., premiums constant in amount for a given age) set by commercial companies, is locked up with the rate of interest used by that company whose proposition is under consideration, the scales drop from one's eyes, the smoke screens of agent's patter are penetrated, and financial sailing proceeds as on a clear day.

The two questions "What kind of insurance shall I buy?" and "From whom shall I buy the kind of insurance I want?" are now susceptible of very simple but general answers.

(a) Buy the kind of insurance which will give your family the requisite protection for the least net payments. The amount required is variable and depends upon the number of one's dependents and their ages. With the average naval officer, living on his pay alone, $30,000 is the least insurance an officer should carry until his family is fully grown and educated, and his sons are in

The net annual premiums for whole life policies per $1,000 for all companies are:

Reserve basis	*Age*	*Annual net premiums*	*Reserves built up at end of years indicated* 5 yr.	10 yr.	15 yr.	20 yr.
3%	25	$16.11	$45.76	$ 98.94	$160 36	$230.50
3½%	25	15.10	33.23	72.78	119.68	174.90

The net annual premiums for twenty-payment life for $1,000 in all companies are:

Reserve basis	*Age*	*Annual net premiums*	*Reserves built up at end of years stated* 5 yr.	10 yr.	15 yr.	20 yr.
3%	25	$24.98	$ 95.49	$208.95	$343.86	$504.59
3½%	25	22.53	83.17	184.14	306.79	456.00

The net annual premiums for twenty-year endowment policy for $1,000 in all companies are:

Reserve basis	*Age*	*Annual net premiums*	*Reserves built up at end of years indicated* 5 yr.	10 yr.	15 yr.	20 yr.
3%	25	$41.01	$185.39	$407.79	$675.54	$929.87
3½%	25	39.14	177.78	396.21	665.59	927.04

The net premium takes into account the two factors of mortality cost, and rate of interest, but does not take into account the loading or overhead charges.

It is the third element only—the loading charge—which accounts for the differences in the net payments and net costs of life insurance.

Once the fact is grasped that two out of the three elements are identical and that the reserve one builds up in paying the level

business. One should pay always by monthly allotments for soon the deduction is not felt.

(b) After buying Navy Mutual Aid and U. S. Government insurance to the extent of $17,500 select for the remaining $12,500 to $17,500 an old-line company, the one whose policy best fits your case and your purse. These two elements ought properly to be decided by the purchaser and not the vendor.

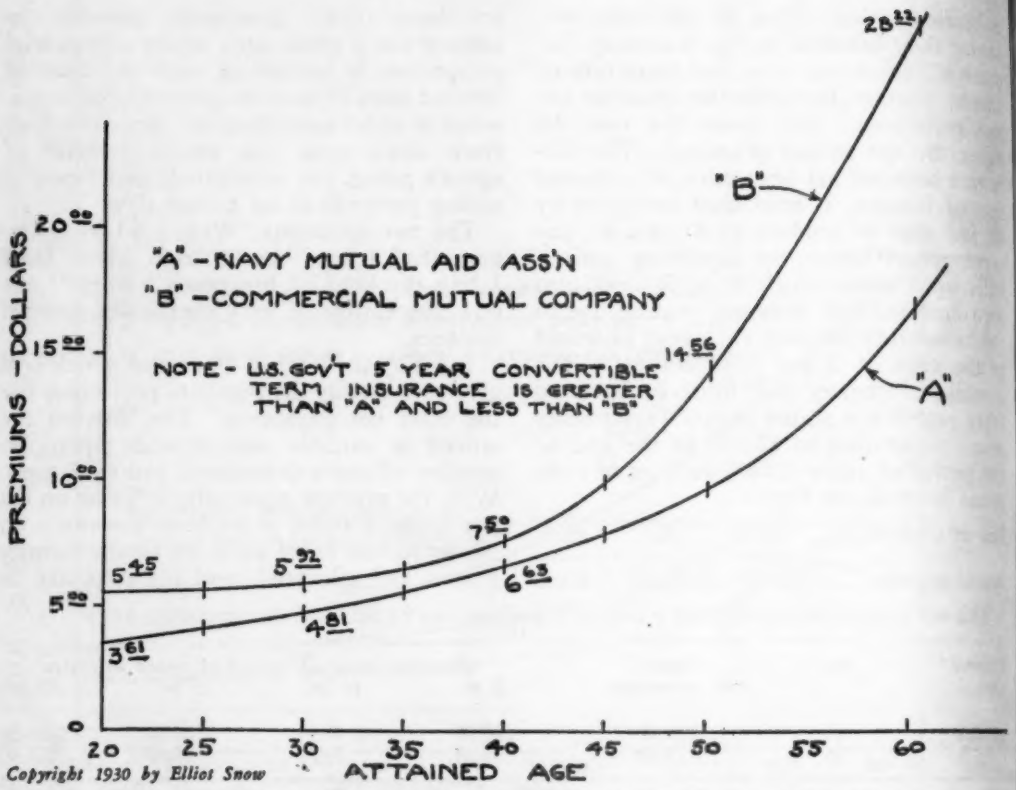

"A" - NAVY MUTUAL AID ASS'N
"B" - COMMERCIAL MUTUAL COMPANY
NOTE - U.S. GOV'T 5 YEAR CONVERTIBLE TERM INSURANCE IS GREATER THAN "A" AND LESS THAN "B"
PREMIUMS - DOLLARS
ATTAINED AGE
"A"
"B"
Copyright 1930 by Elliot Snow

FIG. 3. FIVE-YEAR TERM INSURANCE AND N.M.A.A. COST PER $1,000 BASIS FOR 1929

The five-year term insurance, curve *B*, is renewable and convertible at any time, and the costs have been averaged for the whole five-year period by deducting the dividends from the premiums, giving net cost. For example, at age twenty the level premium (i.e., uniform and equal in amount for each year) is $9.55, but dividends at the rate of $4.10 per year are paid only for the third, fourth, and fifth years.

(5 x 9.55 — 3 x 4.10) = $27.25 for five years or an average of $5.45.

This, in its way, is comparable to Navy Mutual Aid costs if one averages the (1929) costs for twenty to twenty-four years of age both inclusive.

An officer who is a member of the Navy Mutual Aid Association and is carrying U. S. Government insurance to the maximum amount allowable and who wants to acquire more temporary protection at a minimum cost—until he receives an increase of pay—should buy five year, convertible, renewable term insurance. The figures given by curve *B* will afford a safe basis of comparison.

The way to select a company is to write to the Secretary-Treasurer of the Navy Mutual Aid Association and place your problem before him. When doing so ask for the following data on the assumption that you are living at the end of five periods after buying the insurance, i.e., at the end of five years, ten years, fifteen years, twenty years, and at the age of sixty-five. The age of sixty-five is selected because when buying at a young age, say between the ages of twenty and forty, the average future expectation of life falls near to that age. See Fig. 1.

The data to be asked for as of date of the five-year periods selected are: (a) What will be the net annual premiums if you continue to carry the full amount of insurance

TABLE IV

	Age	*Average future lifetime in years. Am. Exp. Table*	*Average age at death*
	20	42.2	62.2
	25	38.8	63.8
	30	35.3	65.3
	35	31.8	66.8
	40	28.2	68.2
Averages	30	35.3	65.3

and continue to pay out for it. This will be based on actual past history dividends.[8] (b) If the policy is surrendered, what cash values and settlement dividends are guaranteed? And what will be the equivalent cost per $1,000 per year? (c) If you desire to continue your insurance but discontinue further payments (1) how long will the full amount of insurance be continued as term insurance? (2) For what reduced amount of insurance will you be covered during the remainder of your life?

These data can be compiled very easily and quickly by any well-posted agent for his own company but you cannot expect him to furnish it for a company other than his own. There are three good reasons for this. (a) It is illegal in many states to make comparisons unless every factor is taken into account and made known to the prospect. Agents often know only their own wares. (b) It is the policy of the largest old line companies to insist that their agents win when in competition with others, without making comparisons. (c) The agents' business is to sell insurance in his own company and you cannot expect him to present an adverse comparison. To sell insurance successfully, the attention of the prospect (of psychological necessity), has to be concentrated on one single form of policy and his emotions played upon in its favor. The agent in ninety-nine cases out of one hundred makes the decision. To buy insurance economically requires that you yourself seek information and shop for what you desire.

Insurance with the Navy Mutual Aid is nothing more or less than automatically renewed term insurance for one-year periods, without medical examination. This being the case it is in its essence the least expensive form of insurance one can buy, particularly as the loading charge is small. Also it becomes a simple matter to compare the cost per year per $1,000 of insurance in the Navy Mutual Aid with similar short-term insurance bought from a commercial company.

[8] It is illegal to promise these same dividends in the future but the future may in this respect be safely judged by the past for all old line companies.

TABLE V

Age	*Cost per year per $1,000 in the N.M.A.A. (1929)*	*Cost per year per $1,000 in a mutual company*	*Cost per year per $1,000 in a stock company*
20	3.61		
25	4.17	7.30	8.57
30	4.81		
35	5.60	8.38	9.52
40	6.63		
45	7.95	11.35	11.87
50	9.68		
55	12.26	20.10	

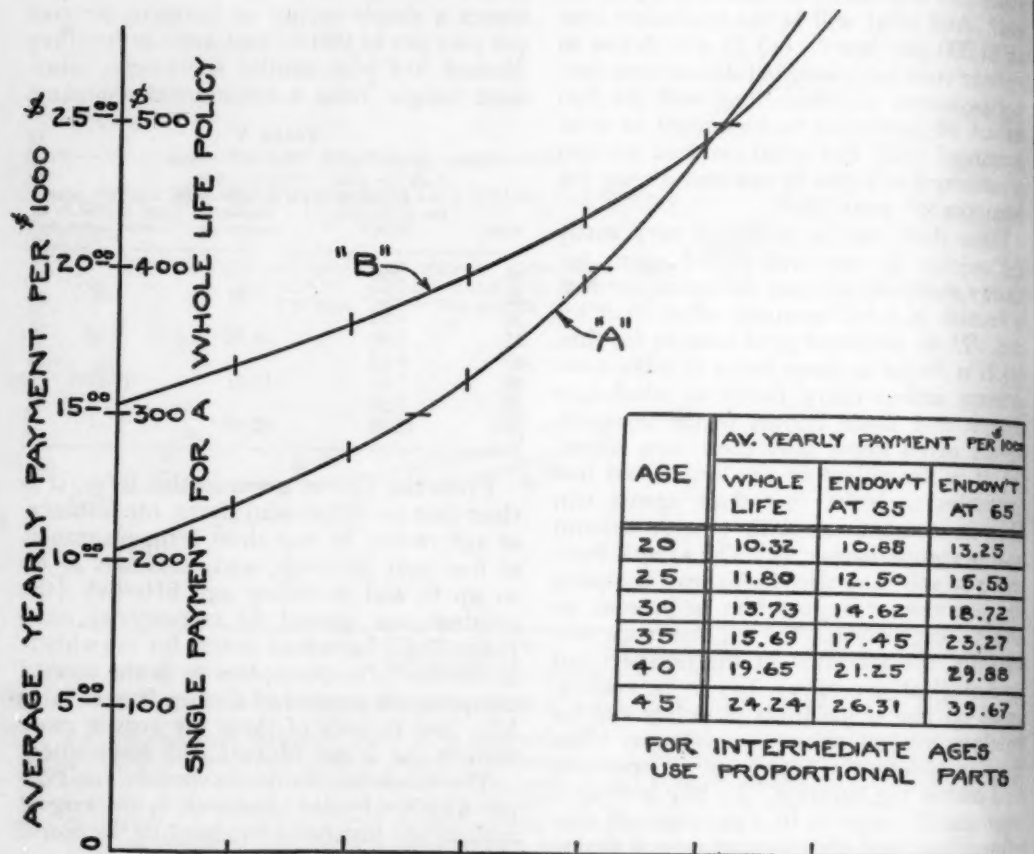
From the figures given in this table, it is clear that an officer who starts, for instance, at age twenty to buy short term insurance, at five year intervals, and continues to do so up to and including age fifty-five (the greatest age quoted by commercial companies) will have paid dearly for his whistle in the stock company; less so in the mutual company, on account of dividends, see Table VI. But in both of these the cost is more than in the Navy Mutual Aid Association.

The tabulated dividend schedule for 1929 per $1,000 of term insurance in the largest mutual life insurance company in the world runs as shown in Table VI.

The primary advantage of insuring while one is young is to increase the period over which protection is bought for one's possible dependents; also the payments are less, and easier to meet monthly simply because they are made over a longer period. The total

Table VI

Premium years	Age 25		Age 35		Age 45		Age 55	
	Div.	Net	Div.	Net	Div.	Net	Div.	Net
1	—	9.90	—	11.16	—	14.63	—	25.75
2	—	9.90	—	11.16	—	14.63	—	25.75
3	4.33	5.57	4.63	6.53	5.29	9.24	7.42	18.33
4	4.33	5.57	4.63	6.53	5.29	9.24	7.42	18.33
5	4.33	5.57	4.63	6.53	5.29	9.24	7.42	18.33
Total		36.51		41.91		56.78		100.49
Average		7.30		8.38		11.35		20.10



AGE	AV. YEARLY PAYMENT PER $1000		
	WHOLE LIFE	ENDOW'T AT 85	ENDOW'T AT 65
20	10.32	10.88	13.25
25	11.80	12.50	15.53
30	13.73	14.62	18.72
35	15.69	17.45	23.27
40	19.65	21.25	29.88
45	24.24	26.31	39.67

FOR INTERMEDIATE AGES USE PROPORTIONAL PARTS

FIG. 4. WHOLE LIFE AVERAGE YEARLY PAYMENTS PER $1,000 AT END OF TWENTY YEARS AT 3½ PER CENT BASIS, 1930 MUTUAL CO.

"A"—Whole life annual premium.

"B"—Whole life single premium.

The author advocates whole life insurance for the average naval officer living on his pay. Or the practical equivalents of this depending upon his age, i.e., endowment at age sixty-five for an officer under thirty years of age; or endowment at age eighty-five with premium reduced after reaching sixty years of age for an older officer. These two latter types of policies may be paid for on a monthly premium basis, the first named on an annual premium basis, unless some special banking arrangement is made.

Data obtained from either of these curves will be safe to use as a basis of comparison with any whole life policy being considered. Curves *A* and *B* are to be used in conjunction with that on Fig. 1. Thus from Fig. 1 ascertain your average expected future lifetime on the supposition that you will live. Use this figure (in years) so obtained as a multiplier of the premium in dollars and cents obtained from curve *A*, Fig. 4. The product will represent closely the total amount you may have to pay—if the divisible surplus conditions of 1930 prevail in the future. For example, at age twenty-five the average future expected life is thirty-nine years $39 \times 11.80 = \$460 =$ amount to be used for comparison. Insurance for life at that age can be had for a single payment of $332.

amount paid for protection cannot be lessened by waiting. A life insurance policy is a long-term contract involving three factors between an individual on the one hand and the company on the other—money paid out, length of time protection is afforded, and salvage value if surrendered.

The three questions which arise in anyone's mind and are asked by the average prospect are these: "What will I put into it? What will I get out of it? When will I get it?" The crux of answers to the contractual obligations into which one enters when buying life insurance has just been illustrated. The answers involve of necessity a rather lengthy exposition which in turn hinges on four simple elements: (a) The mortality cost, (b) the rate of interest assumed, (c) the method (or period of payment), (d) the time the contract runs. A prospect should never guess at these, nor need he do so because accurate data are always easily to be had from disinterested sources.

A life insurance policy bought from a commercial mutual company is in substance a collective agreement between yourself and a large group of other persons (with whom you are not acquainted) to pool death benefits and pay to some central organization the cost of operating the agreement. The accomplishment of this contractual obligation, and the accounting involved thereby are confided to an insurance company with whose officials you, more often than not, are unacquainted. The reverse of this case is that of membership in the Navy Mutual Aid Association. A commercial mutual company does not make a single penny out of its members, but its officers and all engaged in its activities are paid well. The policyholders in a commercial mutual company are on an exact par with the members of the Navy Mutual Aid Association as to being its owners and having a voice in the election of its directorate. The value of this right is not great.

The weeding out processes of the Naval Academy affect relatively a small percentage of the first and second classmen. All young men of their age and circumstance of life who pass up the opportunity to buy for about thirty cents a month a potential estate of $1,000 do so for but one of two reasons: They are either ignorant of the value of life insurance and its saving features, or, because of their youthful state of mind, prefer to take a chance.

Ignorance can be dispelled by a convincing statement of fact. A young man who has once had this destitution of knowledge dispelled and still fails to buy life insurance, gives sure evidence of immaturity of mind. He is deliberately neglecting a sure way of protecting his parents, or guardians who for years have expended much on him. He prefers still to gamble (there is no other equal word to express the idea), to gamble and take a chance against the possible destitution of loved ones. The stake is a paltry sum of money.[4]

Let it be remembered that of every 10,000 young men of age thirty-five in the naval service January 1, 1931, about seventy-eight will "go down to Davy Jones' locker" before the year is out. This statement is a bit disconcerting but is less so if coupled with the thought that out of those 10,000 valuable men a very large percentage will live long and happy lives. Of the 10,000, 96 per cent may expect to live five years longer; 90 per cent may expect to live ten years longer; 85 per cent may expect to live fifteen years longer; 79 per cent may expect to live twenty years longer.

What young officer (in the face of these facts and reading the weekly naval news) dare affirm to his innermost self that he will not be numbered among the 5 per cent, 10 per cent, 15 per cent, or 20 per cent who are soon to cease their labors forever.

The writer presents these elementary facts about life insurance to the readers of the PROCEEDINGS not as a special solicitor in the largest insurance company in the world but as a member of the Naval Institute, and as a long-standing member of the Navy Mutual Aid, who is desirous of helping to promote the morale of the service through aiding the family of every officer to be protected by their breadwinners in the four "united services," whether they be of the Army, Marine Corps, Coast Guard, or of the Navy.[5]

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[4] The writer, to his everlasting regret, through youthful ignorance here openly confessed, was at one time one of those young officers at whom he is now throwing stones. Nature cries out the command: "No longer keep silent when the welfare of some of the future leaders of our Navy is at stake."

[5] The *Thrift Pamphlet* issued by the Bureau of Navigation in 1928 correctly pointed out that there

To any reader who says to himself, "I have no dependents, therefore, why should I insure?" the writer would respond, "Join the Navy Mutual Aid and name the Navy Relief Society as your beneficiary or, some equally worthy charity connected with seamen or the merchant marine, or, if he prefers let him contribute to the national defense of our nation through insurance. Better still will it be if he remembers that some day he may have to provide for an old man —himself.

Let not the ominous words, "too late," some day be flashed upon the wall of your inner consciousness.

"But hark—He stops—He listens—dreadful fate
'Tis his Tormentor's laugh—which echoes 'too late'."

---

is no means other than by life insurance whereby a man can make ample provision for his dependents in the event of his death during the period prior to accumulating a fund sufficient for their needs.

Engraved by T. Rogers

DESTRUCTION OF THE GOSPORT NAVY YARD

Courtesy Naval Records and Library, Navy Department

International News Photos, Inc.

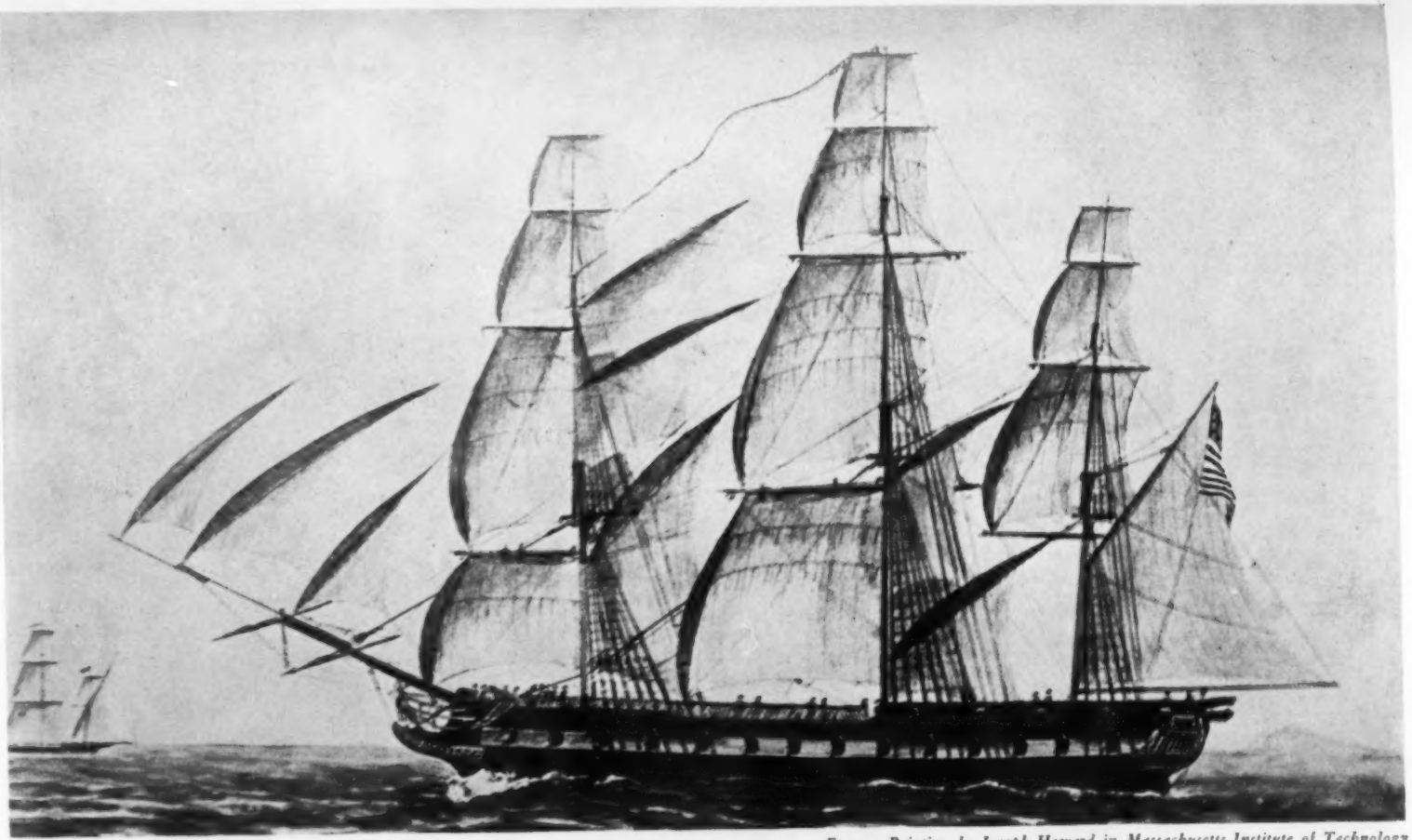
ALWAYS LIGHTS ON ITS FEET

This newly designed plane is said always to make a perfect landing.

International News Photos, Inc.

ALWAYS LIGHTS ON ITS FEET

This newly designed plane is said always to make a perfect landing.



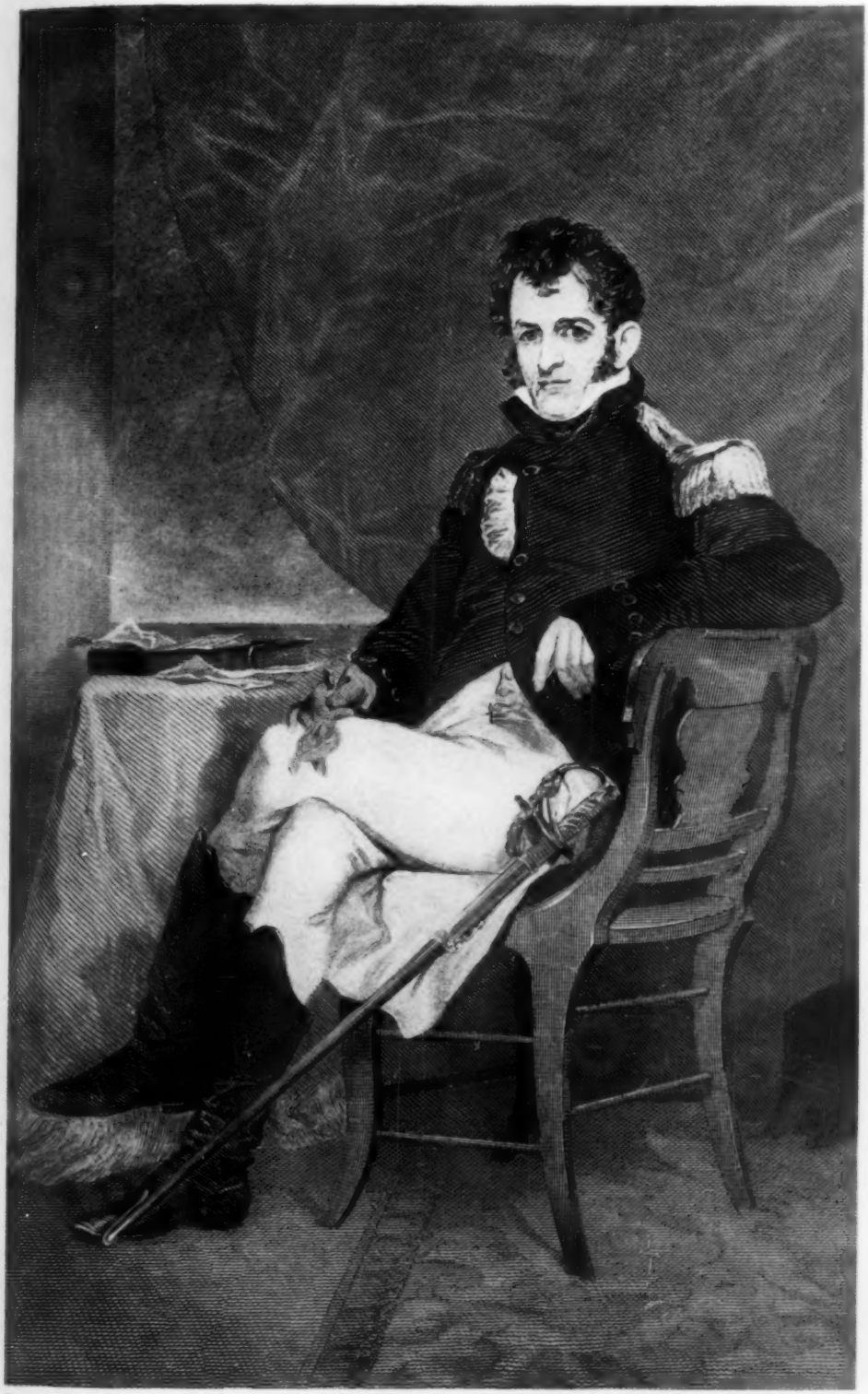
Courtesy Robert W. Neeser

U.S.S. *ESSEX*

From a Painting by Joseph Howard in Massachusetts Institute of Technology

Courtesy Lieutenant Commander Parker H. Kemble, U. S. Naval Reserve

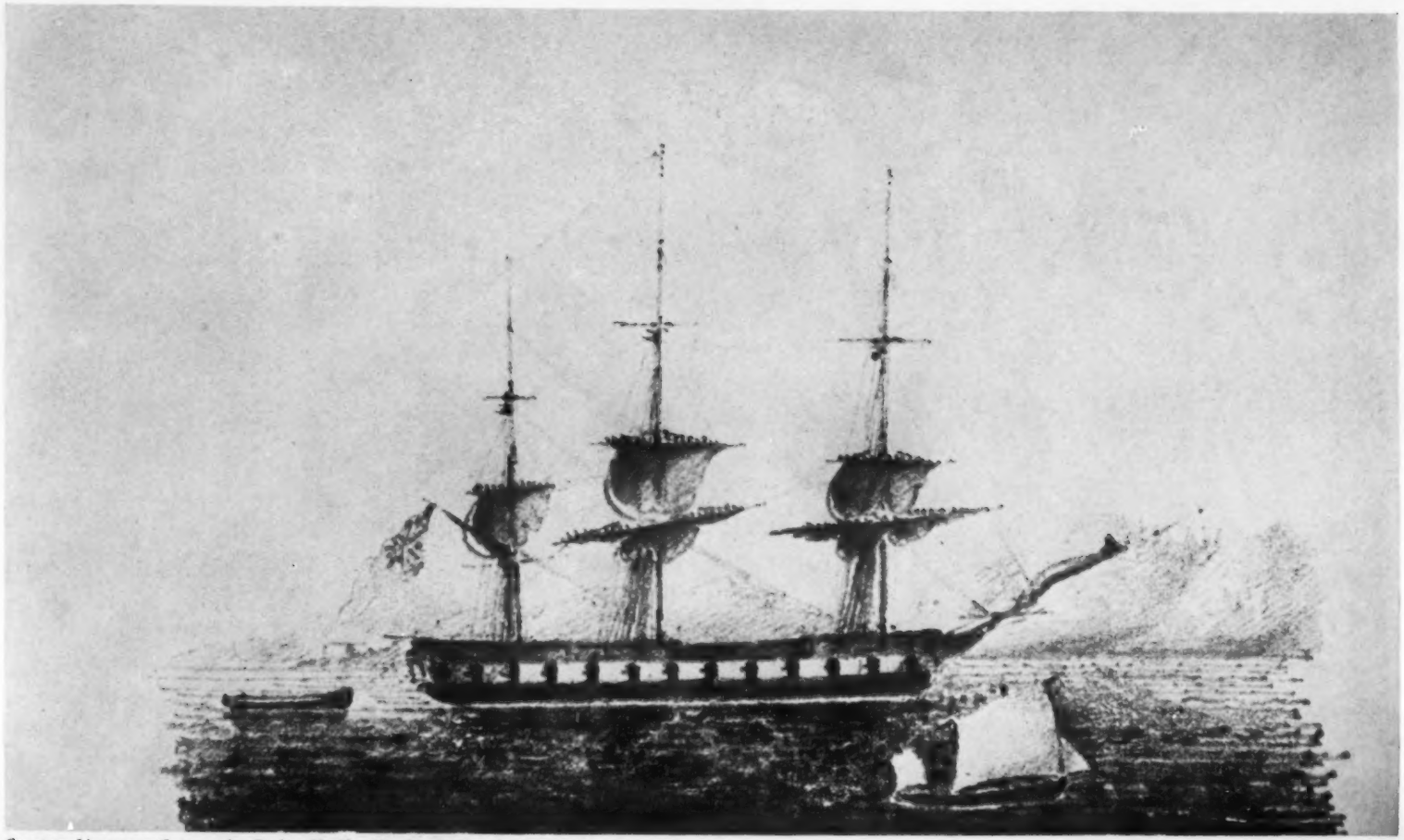
ADMIRAL HILLYAR, COMMANDING H.M.S. *PHOEBE*



Courtesy Naval Records and Library, Navy Department *Copied from Original Painting by Chappel*

ADMIRAL DAVID PORTER, U. S. NAVY

Commander of U.S.S. *Essex* in battle with *Phoebe* and *Cherub*, 1812.

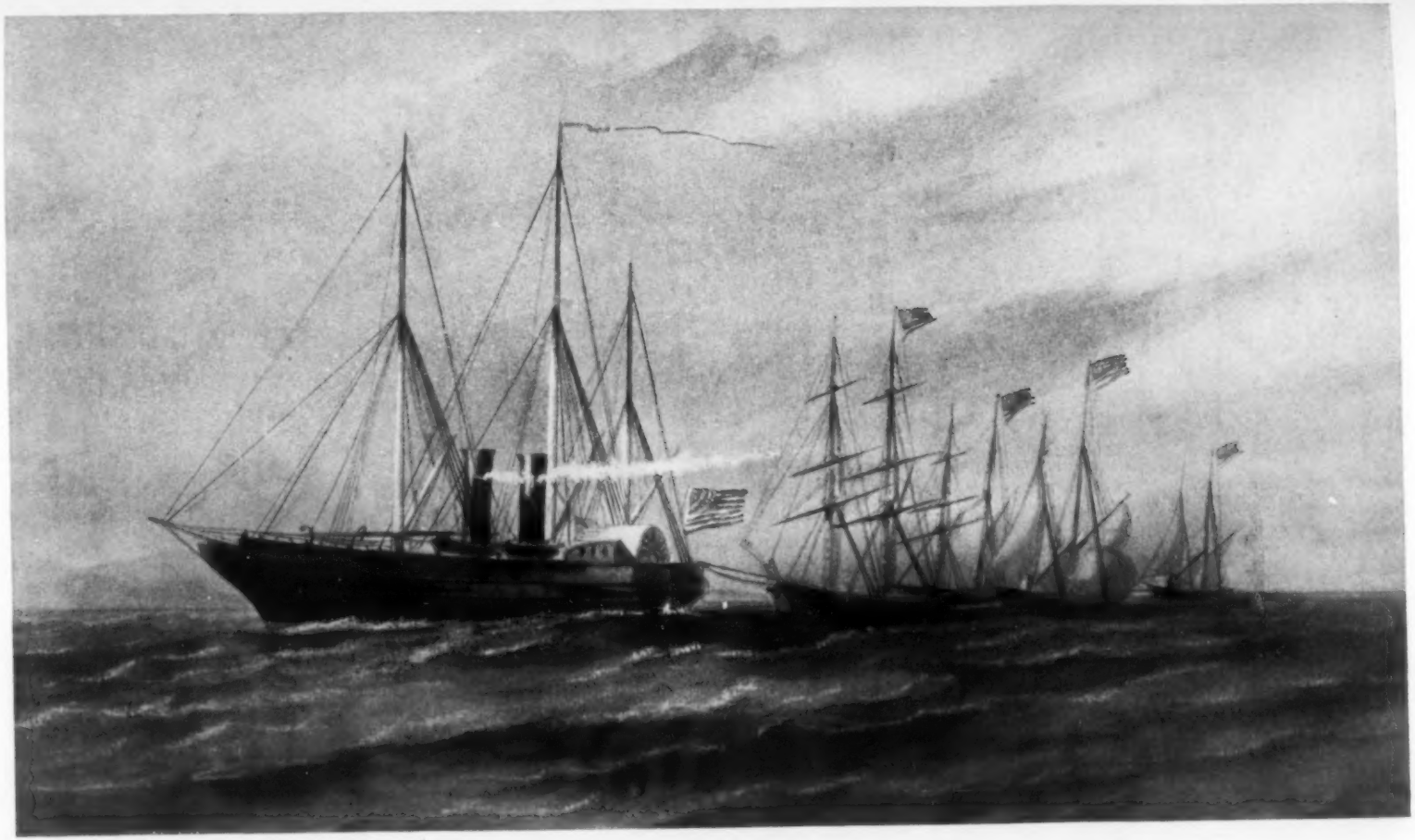


Courtesy Lieutenant Commander Parker H. Kemble, U. S. Naval Reserve

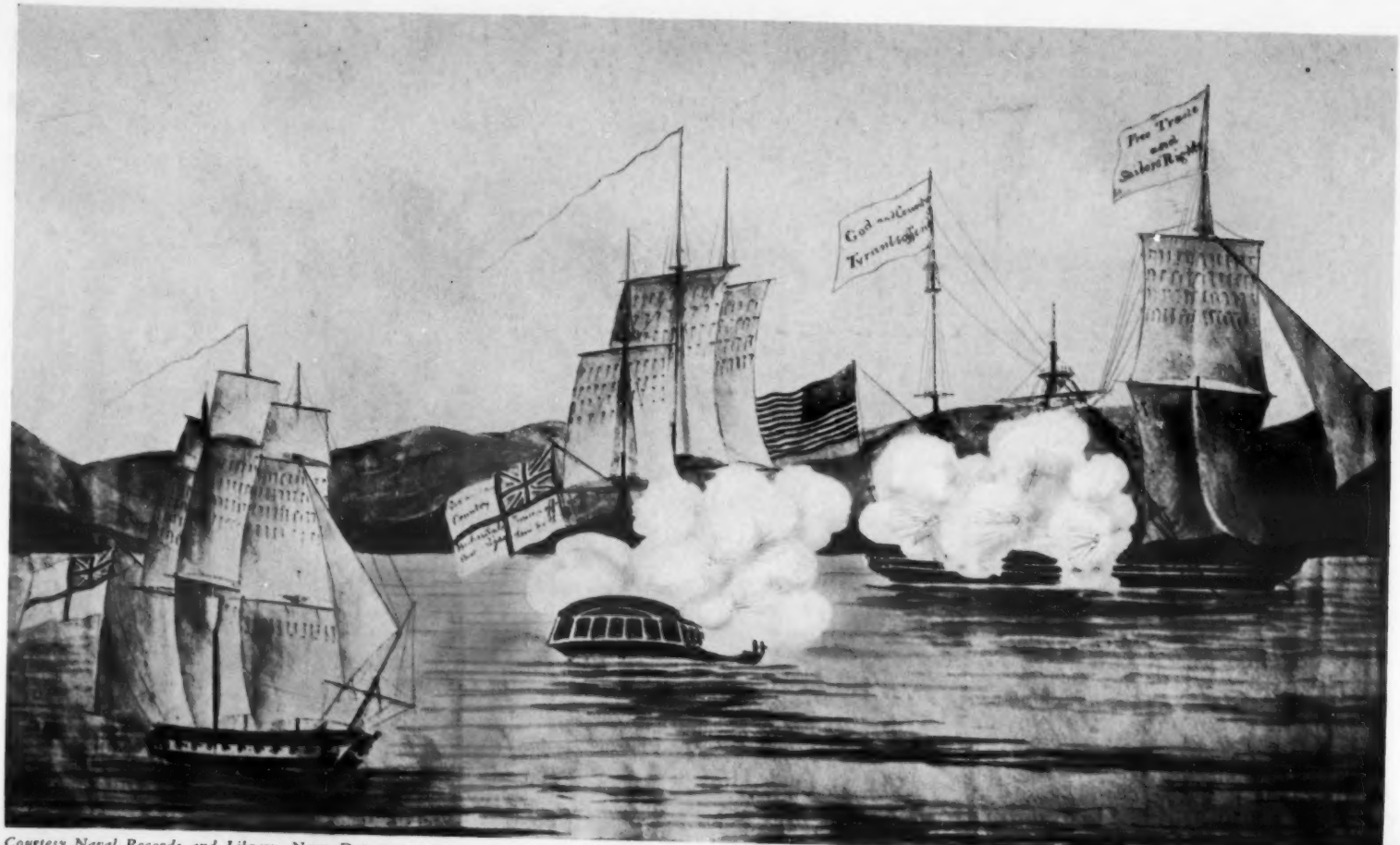
TRUE SKETCH OF H.M.S. *PHOEBE* IN CAPTAIN HILLYAR'S PAPERS

Courtesy Lieutenant Commander Parker H. Kemble, U. S. Naval Reserve

TRUE SKETCH OF H.M.S. *PHOEBE* IN CAPTAIN HILLYAR'S PAPERS



U.S.S. *HORNET* AND PRIZES



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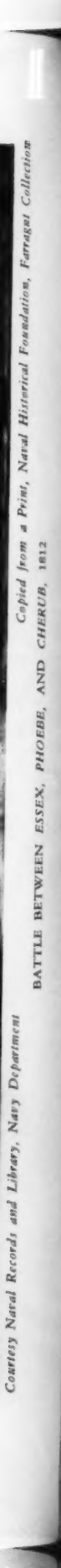
BATTLE BETWEEN *ESSEX*, *PHOEBE*, AND *CHERUB*, 1812


BATTLE BETWEEN ESSEX, PHOEBE, AND CHERUB, 1812
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THE U. S. S. ESSEX VERSUS H. M. S. PHOEBE

By Lieutenant Commander Parker H. Kemble, U. S. Naval Reserve

WHILE in England last summer I met Miss Phoebe Rees, the great, great granddaughter of Captain James Hillyar, who commanded the British frigate *Phoebe* in the action with the *Essex* off Valparaiso, March 28, 1814.

Miss Rees very kindly showed me many interesting souvenirs of the *Phoebe* that she had inherited, among which was the original log book of the cruise and Captain Hillyar's manuscript copy of his report to the Admiralty on the action.

From a study of the engagement it would seem as though two lessons might be drawn, both very applicable to present-day conditions. First, that conventions and treaties, as to freedom of the seas, neutral waters, and so forth, are only valid as far as the power to enforce them can reach, the *Essex* being attacked and captured "so near shore as to preclude the possibility of passing ahead of her without risk to His Majesty's ships"; consequently well inside of the three-mile limit. Second, that weight of metal without equal range is apt to be a delusion, as the thirty long 18-pounders of the *Phoebe*, with their greater range, rendered the heavier battery of the *Essex* ineffective.

Copy of Captain James Hillyar's Report to the Admiralty

His Majestys Ship *Phoebe* in
Valparaiso Bay 30th. March 1814.

Sir

I have the honour to acquaint you for the information of my Lords Commissioners of the Admiralty that a little before three o Clock on the afternoon of the 28th Instant, after nearly five months anxious Search, and Six weeks still more anxious lookout for the *Essex* and her companion to quit the port of Valparaiso, we saw the former under weigh, and immediately accompanied by the *Cherub*, we made sail to close with her. On rounding the outter point of the Bay and hauling her wind for the purpose of endeavouring to weather us and escape, She lost her Main Topmast; and afterwards, not succeeding in an effort to gain the limmits of the port, bore up and anchored so near the shore, a few miles to leeward of it, as to preclude the possibility of passing ahead of her without risk to His Majestys Ships—As we drew near, my intention of going close under her stern was frustrated by the Ship breaking off, and from the wind blowing extremely fresh, our first fire, commencing a little past four, and continuing about ten minutes produced no visible effect, our second a few random shot only, from having increased our distance by wearing, was not, apparently more successful; and having lost the use of our Mainsail, Jib, and Main Stay appearances were a little inauspicious; on standing again towards her, I signified my intention of anchoring for which we were not ready before with springs, to Captain Tucker, directing him to keep under weigh, and take a convenient station for annoying our opponent.

On closing the *Essex* at thirty-five minutes past five the firing recommenced and before I regained my intended position her Cable was cut, and a serious conflict ensued, the Guns of His Majestys Ship gradually becoming more destructive and her Crew if possible more animated, which lasted until twenty minutes past six when it pleased the Almighty disposer of events to bless the efforts of my gallant companions, and my personal very humble one, with victory. My friend Captain Tucker an officer worthy of their Lordships' best intentions, was severally wounded at the commencement of the action, but remained on deck until it terminated, using every exertion against the baffling winds and occasional calms which followed the heavy firing, to close near the Enemy.—He informs that his officers and crew of whose loyalty zeal and discipline I entertain the highest opinion conducted themselves to his satisfaction.—I have to lament the death of four of my brave companions, and one of his; With real

sorrow I add that my first Lieutenant, Ingram is among the number: he fell early, is a great loss to His Majesty's Service and the many manly tears which I observed this morning while performing the last mournful duty at his funeral on shore, more fully evinced the respect and affection of his afflicted companions, than any eulogium my pen is equal to. Our list of wounded are small and there is only one for whom I am under anxiety. The conduct of my Officers and Crew without an individual exception that has come to my knowledge, before, during and after the Battle was such as became good and loyal subjects, zealous for the honour of their much loved, though distant, King and Country; I believe I may still add a higher species of praise and say such as Christians should observe they joined me in asking the blessing of the Almighty previous to the Battle, met their Enemy with cheerfulness, generously felt for them when subjued, and humbly ascribed their preservation and victory to the kindness of that gracious Being to whom they wish to repose their trust.

The defence of the *Essex,* taking into consideration our superiority of force; the very discouraging circumstance of having lost her Main Top Mast, and being twice on fire, did honour to her brave defenders, and most fully evinced the courage of Captain Porter and those under his command; Her colours were not struck until the loss in killed and wounded was so awfully great and her shattered condition so seriously bad as to render further resistance unavailing. I was much hurt on hearing that her men had been encouraged, when the result of the action was evidently decided, some to take to their boats and others to swim on shore; many were drowned in the attempt, sixteen were saved by the exertion of my people. I believe between thirty and forty effected their landing: I have informed Captain Porter, that I considered the latter, in point of honour, as my prisoners; he said the encouragement was given when the Ship was in danger from fire, and I have not pressed the point,—The *Essex* is completely stored and provisioned for at least three months and although much injured in her upper-works Mast and rigging, is not in such a state as to give the slightest cause of alarm respecting her being able to perform a voyage to Europe with perfect safety,—Our Main and Mizen masts are rather seriously wounded these with a few shot holes between wind and water, which we can get at without lightening and a loss of canvas and cordage which we can partly replace from our well stored prize are the extent of the injuries His Majesty's Ship has sustained. I feel it a pleasant duty to recommend to their Lordships notice my now Senior Lieutenant, Pearson and Messrs Allen Gardner, Porter, and Dew, midshipmen, and to request they will do me the honor to confirm my acting appointments since passing Cape Horn, of Messrs Henry S Gardner, Kirby and Rickard as Lieutenants; Nichinson as Purser, and In. . Gillespie as Boatswain, all unhappoly in consequence of death vacances, they have acquitted themselves well with me in Battle, the two Gardners, and Kirby on two occasions.

I should do very great injustice to Mr George O Brian, the Mate of the *Emily,* Merchantman who joined a Boats Crewe of Mine in the Harbour, and pushed for the ship the moment he saw her likely to come to action, were I to omit again recommending him to their Lordships. His conduct with that of Mr N. Murphy Master of the English Brig *Good Friends,* was such as to entitle them to my lasting regard and prove that they were ready to hazard their lives in their Countrys honorable cause. They came on board when the attempt was attended with great risk and both their Boats were swamped.—I have before informed their Lordships that Mr O Brian was once Lieutenant in His Majesty's Service (may now add that youthful indiscretions appear to have given place to great correctness of conduct) and as he has proved his laudable zeal for its honor, I think if restored he will be found to be one of its greatest ornaments. I enclose returns of killed and wounded and, if conceived to have tresspassed on their Lordships time by this very long letter, I hope it will be kindly ascribed to the right cause—an earnest wish that merit may meet its due reward.

I have the honor to remain
Sir
(Sig d) Jas. . Hillyar.

To
J. W. Croker Esq
Secy to the
Admiralty
London.

P.S.
There has not been found a Ships Book or Paper of any description, (charts excepted) on board the *Essex*, or any document relative to the number serving in her previous to the action. Captain Porter informed me that he had upwards of two hundred and sixty victualled: Our prisoners, including fifty two wounded amount to one hundred and sixty-one, twenty-three were found dead on the decks, three wounded were taken away by Captain Downs of the *Essex Junr* a few minutes before the Colours were struck, and I believe twenty or thirty reached the Shore, The remainder were killed or drowned.

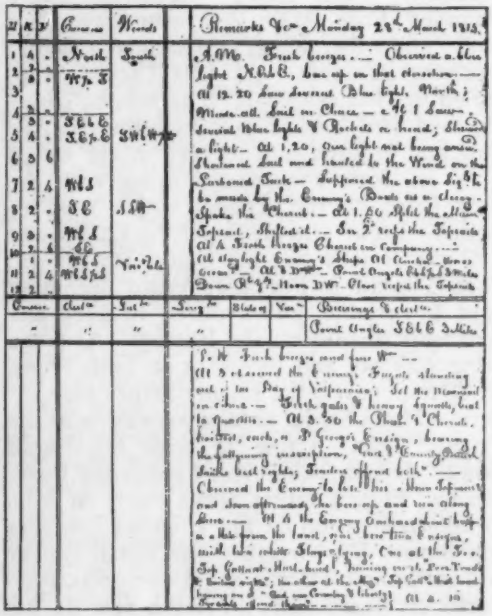
EXTRACTS FROM THE "LOG" OF THE PROCEEDINGS OF HIS MAJESTY'S *Phoebe*

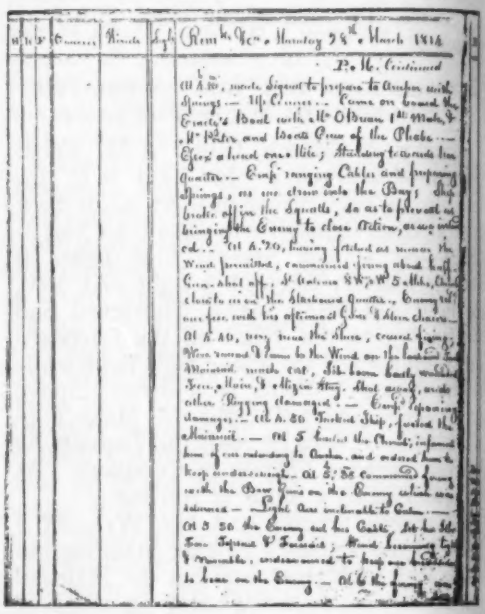
Monday 28 March 1814. A.M. Fresh breezes.—Observed a blue light N.E. E., bore up in that direction.—At 12.20 Saw Several Blue lights North; Made all Sail in Chace—At 1 Saw Several Blue lights & Rockets ahead; Shewed a light—At 1.20, our light not being answd, Shortened Sail and hauled to the Wind on the Larboard Tack—Supposed the above sigls to be made by the Enemy's Boats as a decoy—Spoke the *Cherub*.—At 1.40 Split the Main Topsail, Shifted it.—In 2d reefs the Topsails At 4 Fresh breezes *Cherub* in Company. At daylight Enemy's Ships at Anchor—
P.M. Fresh breezes and fine Wr.—At 3 observed the Enemy's Frigate Standing out of the Bay of Valparaiso; Set the Mainsail in chace.—Fresh gales & heavy Squalls, beat to quarters.—At 3.50 the *Phoebe* & *Cherub*, hoisted, each, a St George's Ensign, bearing the following inscription, "God & Country, British Sailors best rights; Traders offend both".—Observed the Enemy to lose his Main Topmast and Soon afterwards he bore up and ran along Shore.—At 4 the Enemy Anchored about half a Mile from the land, and hove two Ensigns, with two white Flags flying, one at the Fore Top Gallant Masthead, having on it, "Free Trade & Sailors rights"; the other at the Mizn Top Gallt Mast-head having on it "God our Country & liberty. Tyrants offend them". —At 4h. 10m. made Signal to prepare to Anchor with Springs.—Up Courses.—Came on board the *Emily's* Boat with Mr OBrian 1st Mate, & Mr Porter and Boats Crew of the *Phoebe*.—*Essex* ahead one Mile; standing towards her Quarter.—Empd ranging Cables and preparing Springs, as we drew into the Bay; Ship broke off in the Squalls, so as to prevent us bringing the Enemy to close Action, as we intented.—At 4.20 having fetched as near as the Wind permitted, commenced firing about half Gun-shot off, St Antonio S W ½ W 5 Miles, *Cherub* close to us on the Starboard Quarter—

Enemy retd our fire with his aftermost Guns & Stern chacers.—At 4.40, very near the Shore, ceased firing; Wore 'round & came to the Wind on the larboard Tack; Mainsail much cut, Jib-boom badly wounded, Fore, Main, & Mizen Stay, Shot away, and other Rigging damaged.—Empd repairing damages. At 4.50 Tacked Ship, furled the Mainsail.—At 5 hailed the *Cherub*, informed him of our intending to Anchor and ordered him to keep under weigh —At 5h. 35m. commenced firing with the Bow Guns on the Enemy which was returned—Light airs inclinable to Calm.—At 5.50 the Enemy cut his Cable, set his Jib Fore Topsail & Foresail; Wind becoming light & variable, endeavoured to keep our broadside to bear on the Enemy.—At 6 the firing was hot and incessant on both Sides. At 20 min. past 6 the Enemy Struck his Colours.—Made Signal to take possession of the Prize. Calm.—Came to with the Small Bower, furled Sail.—Sent Lieutenant Pearson two Petty Officers and a Party of Men to take possession of the Prize—Light airs and hazey Wr,—weighed the Small Bower and made Sail—Boats empd as necessary—Came on board Cap. Porter a few of his Officers & part of his Crew. At 12 Calm. Came to with the Stream Anchor in 34 Fms: furled Sails.

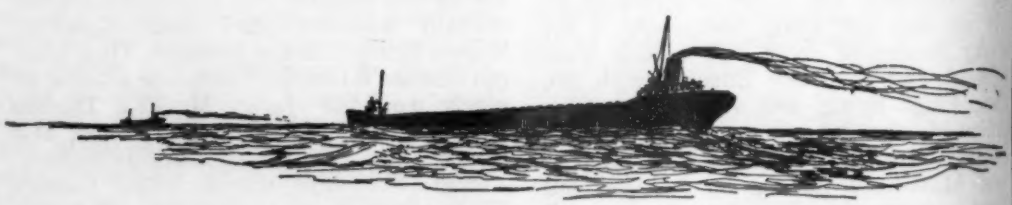
The following Men were killed in Action viz: Thomas Griffiths, Ab, Willm Knowels, Ab, Dennis Murphy, Ab, Lieutenant Ingram mortally wounded—died about Midnight. Robert Bruce, Humpy Jameson, Thos Warren Seaman & George Fieldhouse Marine severely wounded—James Madden, Thomas Millery (Seamen) and James Evans, Marine, slightly. *Cherub's* Return as follows: —Wm Derbyshire Marine, killed, Captain Tucker severe contusion John Edwards Corpl Marines and Christopher Rafferty Private Marine slightly wounded.—Damages pr Carpenter's report.—Seven 32 pns between Wind and water & one 12 pns 3 feet under water—Thirteen 32 & 12 pns into

the Waist & qr deck—A number of Grape Shot & Musket Balls in different parts of the Ship—Starbd Bill board and Bolsters, three chain Plates and three dead Eyes Shot away—Hammock Boards and Stantions, Boats, Cabins, 2d Galleries and Sashes considerably damaged—Main Mast-head wounded badly, wounded also below 1st qr: with Cannon shot.—Main & Main Topsail yards Mizzen Mast Jib-boom and Spritsail Yard severely wounded.—Gunner's report. —Transom & Transom Bolt damaged, of an 18 pns—An Axeltree of a nine Pn carriage—a 12 pn Cannonade Slide destroyed & 2 Cap Squares.— Boatswain's Report—Cutter Swampt—all her Oars & Geer lost, One Fore Top Gallant Studdingsail—200 yards of Main Topmast Staysail.—Thirty Fms of Spring hawser 4½ Ins—Jib Guys, Martingale & Stay.—Messenger Carlet of 11 In 4 Fms for yarns—Bowsprit Gammoning—three eight Inch & 4, 6 Inch Single Blocks





PHOTOSTATIC PAGES FROM *PHOEBE'S* LOG



THE REICH CALLS A HAND

By Captain George J. B. Fisher, U. S. Army

ON OCTOBER 29 the foreign affairs committee of the Reichstag formally called on the German government to bring to an end the perilous situation wherein a "disarmed Germany is surrounded by ever increasing preparations for war."

These preparations for war involve principally land armaments, which in the present scene have replaced naval armaments as breeders of international antagonisms.

In this sphere Germany is facing a genuine dilemma, the solutions to which are limited. Actually there are but two possible plans by which her dangerous position may be relieved. Either the German Republic must cease to be "disarmed"—must be allowed an army somewhat comparable to those of the hostile powers about her, or those powers must reduce their land forces to a par with Germany's.

It is a hopeful sign that the newly formed German government urges as it does the latter course, rather than permission to build the German Army toward pre-war levels. The moderation of this position is especially significant in view of the temper of the recent political revolution in Germany.

Were the members of the new Reichstag fully responsive to the wishes to their electors a full-sized army would be demanded along with the abrogation of practically all of the Versailles Treaty. For, despite the complexities and cross purposes of German politics, all parties are united in demanding a lessening of what the French term the logical consequences of defeat.

When President Hindenburg dissolved the German parliament to evoke a new election on September 14, it was confidently hoped that a more homogeneous legislative body might be brought into existence. Politically the enfranchised German suffers from excessive individualism. This, together with a paucity of strong political leaders, has made progressive reconstruction under the republic particularly difficult. It was the myriad parties represented in the Reichstag, and especially the intransigence of their representatives, that brought about the midsummer crisis in the Bruening cabinet. But these evils were, if anything, aggravated by the ensuing elections.

The voting population turned out *en masse* in September and sent 576, or an increase of 80 members, to the new Reichstag. These were divided into thirteen political parties, including all graduations of reaction to democratic government. The so-called Fascists, who would replace the Weimar Constitution with a dictatorship, made a startling gain from 12 to 107 members. The Communists, at the opposite extreme of political thought, drew a popular vote of four and a half millions and a Reichstag bloc of 76 favoring the Third International. The unexpected strength developed by these two radical parties indicated that the election was in fact a referendum of representative government.

In considerable degree the radicalism of the present Reichstag is traceable to the youth movement in German politics. The youngster born in 1910, 1909, 1908, had no personal experience in the war, had no individual realization of defeat. Yet he was exposed in adolescence to all the discontenting influences of reconstruction. And now, at twenty, he votes. And the weight of his vote is increased by the absence of the German war dead from the polls.

But the deeper political disaffection in Germany is partially a reaction to world-wide economic disturbances, partially a result of disagreement over domestic issues. The solutions proposed are so various and their proponents so numerous that a continuation of coalition government is inevitable. Yet on the broad features of foreign policy all these divergent political elements see with singular unanimity.

The theory of war guilt as expounded by the treaty of Versailles is renounced by the average German, and its repudiation is therefore a battle cry alike of Communist,

Fascist, and Monarchist. The stimulation of a sturdy nationalism, the creation of a representative national army, are objectives increasingly sought throughout the country. The surprise is not that the Germany of 1930 is definitely raising the armament issue, but that the manner of the raising is so temperate.

When at the peace conference the allied conferees set about to demilitarize Germany, they made a thoroughgoing job of it.

Of course the present authorized Army of 100,000 has its points. As was to be expected, German ingenuity has been concentrated during the past decade in making the most of this quota. General von Seeckt in particular has tried to do for his country what Scharnhorst accomplished after the Napoleonic defeat, and his achievements evoke the admiration of dispassionate observers.

The long service requirements of the Versailles Treaty—twelve-year enlistments—have naturally favored high professional efficiency, which is not amiss in an age of military complexities. Nor is this efficiency militated against by the high rates of pay which Germany is forced to grant her soldiers. But these incidental advantages do not compensate for the stinging deficiencies in heavy artillery, tanks, and military airplanes.

It is true that Germany has built epochal planes across the border in Switzerland, that she has steadily developed her chemical resources and technique. But a comprehensive violation of her disarmament obligations has been checked, if only by the prying eyes of enemies within her gates. The Stahlhelm, with its million banded ex-service men, is no doubt a military asset; yet a poor substitute for trained national reservists under the disposition of an organized general staff.

The thoughtful German has cause for nervousness when he sees the inadequacy of the post-war German Army to control the internal dissensions which appear to loom ahead. And he is scarcely reassured when he looks abroad to see on either flank hostile millions prepared for military action.

The difficult situation which Germany is facing from the lack of a suitably relative military organization comes about because Europe is today living under conditions far different from those envisaged by the peacemakers of Versailles.

The ideology of the peace conference, of which Clemenceau complains in *Grandeur and Misery of Victory*, directed itself to eliminating the causes of warfare. It went further and contemplated this happy achievement as already consummated.

According to this theory, the need for armaments had ceased. Germany would therefore disarm; not as a penalty for defeat, since revenge was unseemly (note the apt usage of "reparations" rather than "indemnities"), but for the good reason that the whole world would shortly be disarmed and Germany would thus have no use for either army or navy.

So the extent of German disarmament was defined, "In order to render possible the initiation of a general limitation of the armaments of all nations." But the disarming of the victorious powers was too tedious a task to complete incident to the peace treaty; the assurance was given therefore that the allied and associated powers would soon meet again and then similarly reduce their own military establishments.

In due time the preparatory disarmament committee of the League of Nations was organized to effect the "spade work" preliminary to this general disarmament. Its task, extending over the past four years, was brought to a close in December and then largely because of the insistence of both Great Britain and the United States that the disarmament issue graduate from the preparatory stage. A final act of this commission was to deny, by a vote of fourteen to four, Germany's request that a formal disarmament conference be called by the League of Nations not later than November 1931 (thirteen years after the Armistice) instead of, as finally arranged for, "as soon as possible." It is now hoped that this conference may be held in 1932, although the exact date depends on the ability of the powers concerned to iron out some vexing problems which the preparatory disarmament commission was unable to untangle.

Whether this big disarmament event, if and when held, will bring about any substantial change in the present European situation is a matter of speculation. Meanwhile and notwithstanding the failure of the nations composing the league to achieve that ideal amity visioned by the treaty of Versailles, Germany continues virtually unarmed amongst the current hostilities that

have sprung up about her. Her plight is fraught with a danger wholly unseen in 1919.

The military consolidation of the victory of 1918 was planned by the allied and associated powers along lines which were eminently practical yet apposite to the main body of the peace treaty. The history of this plan furnishes a key to the military alignments of post-war Europe.

At the peace conference France, still quivering, was willing to disarm, but only provided she was given assurance of aid in case of renewed German aggression. This aid was promised readily enough, in the names of the British Empire and the United States. The resulting treaty of assistance, signed in 1919, was worth more to France than all her own military and physical resources; it would have justified her virtual disarmament, since it carried untold moral and economic support. But this arrangement, along with the Versailles Treaty, was rejected by the United States Senate. For this reason, Britain in turn withdrew from it. So, on this vital phase of the peace negotiations, France found herself gently but firmly let down after the peace had been consummated!

The abortive failure of the guarantee pact caused France to put aside her tentative plans for disarmament. This also caused the Quai d'Orsay to look elsewhere for those strengthening alliances for which the French felt such need.

The guaranteed neutrality of Belgium, a diplomatic landmark, was soon replaced with an intimate Franco-Belgian military accord. Then Poland, inspired more by fear of Russia than of Germany, was drawn into this alliance. Poland's entrance gave the league some appearance of encircling Germany, yet on the whole this new coalition seemed the only practical substitution for the neutralized Rhineland which had been first promised and then denied by Great Britain and the United States.

But France did not stop here. From this foundation French military influence spread into southern Europe, where it found sympathetic reception in Czechoslovakia, Rumania, and Yugoslavia. By 1927 all of these nations had been consolidated under French military leadership into the now formidable Little Entente.

Critics of French policy see in this latter movement little of the security feature which justified the original Belgian and Polish alliances. By them it is seen rather as a drawing away from World War actualities—as a consolidation to meet the less obvious exigencies of the next war. But France, saturated with traditional fear, views this coalition as the only certain means of preserving peace. At any rate it is the logical outgrowth of the security-through-armament principle, the theory of which is opposed by Great Britain and the United States.

The military strength of this French alliance reaches staggering proportions, far beyond anything that was thought of when the disarmament of Germany was dictated. The standing armies involved include France, 500,000; Belgium, 70,000; Poland, 250,000; Czechoslovakia, 125,000; Rumania, 130,000; and Yugoslavia, 125,000. But these are only first-line troops. With them must be considered the trained reserves of these powers, troops available for mobilization within one or two weeks. The aggregate of these two classes gives the alliance a combat strength in excess of eleven million men!

This is beyond the entire man power mobilized by Germany during the whole of the World War.

Against such an array of might, Germany's present army is a mere firing squad. The steady growth of French military influence during the past decade has therefore caused Berlin much uneasiness. The same sensation has also been experienced by France's southern neighbor, Italy.

In taking unto herself these new allies, France necessarily assumes their burdens of hatred along with the benefits of their military support. Among the Balkan states these hatreds are notoriously fulsome.

The rapprochement between France and Yugoslavia especially has fanned the flames of Franco-Italian antagonism. By the London Pact of 1915 Italy exacted, as her price for entering the World War, important concessions on the Dalmatian coast. Her aspirations in this area were never completely fulfilled, because of the subsequent breakup of the Austro-Hungarian Empire. Nevertheless Italy has a keen geographic interest in the eastern shore of the Adriatic. The latent hostility of the southern Slavs who inhabit this region is irritating, but their outright friendship for France has created much bitterness.

The long road which France has traveled in search of security through alliances has aroused animosities as well as friendships. The necessity for this policy it was hoped would be eliminated by the Locarno pact. The Kellogg pact and even the League of Nations are agencies designed to end the need for an armed peace. Yet the French alliances continue, a striking paradox to the preamble of the Versailles Treaty, "In order to render possible the initiation of a general limitation of the armaments of all nations. . . . ."

This dangerous situation, of which Germany is today complaining, presents an historical parallel to conditions in Europe fifty years ago. Then an alliance arose out of the Franco-Prussian War, consisting of Germany, Austria-Hungary, and Italy—the well-remembered Triple Alliance. The threat of this combine forced France into an unnatural partnership with imperialistic Russia, forming the Dual Alliance. This, with the later admission of Great Britain, became the Triple Entente. With these two groups glaring at each other through the years, it required only the irresponsible action of one ally, Austria, to drag the whole world into war.

The dangerous system which made this possible appears on the verge of regeneration.

It is too much to suppose that the military domination of Europe which France now exercises will go long unchallenged, any more than the Prussian ascendancy of 1880 was permitted to.

Its answer will be found by those nations which today bear the most obvious hostility to France, the identical powers who before the war composed the Triple Alliance—Italy, Germany, Austria, and Hungary.

To such a combine Germany offers valuable contributions in the shape of physical resources and technical capabilities. But in her present disarmed state she is, from a military viewpoint, more of a liability than an asset. But how long will Germany remain disarmed?

The treaty of Versailles was never intended as an *ultima Thule*. No such treaty can be. It was simply intended as a *modus vivendi* for the days of transition between the old and new eras. That the new era proves far different from the expected millennium under the League of Nations does not alter the fact that it has arrived.

So Germany now calls the hand of the war-time allies on the disarmament issue. She finds most of her erstwhile opponents today scattered and engrossed in their own newer interests. She may not even obtain a quorum to hear her case. But at least Germany has the historical perspicacity to go on record as first beseeching her neighbors to disarm before she reluctantly rearms.

ADDITION–SUBTRACTION LOGARITHMS

By L. M. Berkeley

(See page 279 this issue)

IN THE year 1802 there was published at Bordeaux a little work of the highest interest and importance. The title was *Supplément Logarithmique*, and the author was a young Italian mathematician named Zecchini Leonelli. The book being published in the lengthening shadow of the French Revolution, the date on the title page is given as *"l' an XI."* It contained among other things the complete theory, illustrated by actual examples, of addition-subtraction logarithms.

The purpose of these logarithms is to obtain the logarithm of the sum or difference of two numbers when the logarithms of the numbers are known, but not the numbers themselves. In other words, given log a and log b, to find log $(a + b)$ and log $(a - b)$, without finding a and b in the process. The great utility of such a table seems obvious to the modern mind; but it was not so in the year XI of the French Revolutionary era.

The young author had his living to make and did not have the time to undertake the laborious calculations necessary to embody his idea in concrete form. He had previously endeavored to obtain scientific support for the project. He had sent a memoir to the famous French Institute (Institute National des Sciences et Arts), explaining the idea and proposing to calculate a table accordingly. The memoir was referred to a committee composed of Delambre and Lalande, two of the most eminent mathematicians in France. On the first day of Floréal, in the year X of the French Republic, Citizen Delambre presented a report on the matter. Delambre, though only Citizen Delambre in the eye of the law, was a famous astronomer and mathematician, well-known for his classical work in measuring a meridian arc from Dunkirk to Barcelona. His report showed plainly that he had misunderstood the plan in part; and as for the rest he thought the proposed tables would be too voluminous and expensive to have any practical value. He evinced a preference for a clumsy substitute, which had the merit of being already familiar to him.

The other member of the committee, Citizen Lalande, contented himself with merely concurring in the report. Is it *lèse-majesté* to the departed great ones of the scientific world to express a doubt whether Citizen Lalande had read Leonelli's memoir?

The session thereupon approved the report, adopted its conclusions, and consigned the whole matter to the dust of its archives. And this was the reception extended to important new ideas in the year X of the new earth, initiated by the French Revolution!

Leonelli did not acquiesce meekly in being thus suppressed. Like many another author subjected to shallow criticism, he was recalcitrant. He sent a spirited remonstrance to Citizen Delambre, pointing out that the Citizen had objected to certain matters which could easily be obviated, had misunderstood certain other matters, and had flatly misrepresented still others. But he had his labor for his pains. The oracle had spoken, and thenceforth was dumb. The only answer the young man received was a profound silence.

Still not acquiescing, Leonelli published his work as above stated. It seems to have fallen absolutely flat, at least in the country of its publication. But some time after, a copy fell into the hands of Gauss, who, being a German, was probably not so critical about the French style of the author as a native Frenchman would be. Gauss was a practical computer, as well as a mathematician of the first rank, and he saw at once the utility of the proposed plan. So delighted was he with the scheme that he at once set to work and calculated a table simply for his own use. This table remained in manuscript for some years and was finally published. But Gauss never claimed to be the author of the invention; on the contrary, he freely awarded the credit to Leonelli.

Leonelli lived until 1847. He seems to

have pursued rather a wandering existence, in consequence, perhaps, of being somewhat "temperamental," as the word is used in Thespian circles (the French equivalent is *difficile*). He continued to write at intervals on scientific subjects, but seems never to have recurred to his youthful project. He lived to see the logarithms that he devised published under the name of Gauss, and known generally as Gaussian logarithms. His own connection with them is rarely mentioned in the histories of mathematics. The works of Fink, Ball, and David Eugene Smith do not even give his name, and there is only a bare mention in Cajori. As has so often happened in the history of mathematics, his shade would be entitled to quote the complaint of the Roman poet: *Hos ego versiculos feci, tulit alter honores.*

The whole episode has been exhumed from the dusty archives of the Institute by Professor Hoüel of Bordeaux, and has been set forth at length with due credit to Leonelli. Of his work Professor Hoüel says: *"L'ouvrage . . . . assure à Leonelli un titre impérissable à la reconnaissance des calculateurs."* Surely this ought to satisfy any mathematical shade, even the most "temperamental."

In Germany also the historical facts are now recognized; for though Dannemann (*Die Naturwissenschaften*, vol. 3, p. 343) gives the credit to Gauss, Tropfke (*Geschichte der Elementar-Mathematik*, vol. 2, p. 216) states the facts correctly, and calls the name "Gaussian" logarithms *"durchaus unberechtigt."*

The table published by Gauss, with the immense prestige of his name (*clarum et venerabile nomen*), brought addition-subtraction logarithms to the attention of the scientific world; and on the continent of Europe they are well known. In English-speaking countries, however, they have been less popular. Apparently, this is because America, heretofore, has derived its mathematics mainly from Cambridge, and Cambridge has derived its mathematics mainly from itself. If Gauss had been a Cambridge don, these logarithms would probably be now universally known. As it is, even professional mathematicians are sometimes unacquainted with them.

Another reason for the lack of appreciation of addition-subtraction logarithms is the fact that the editors of such tables have been unwilling to extend the tables adequately. These logarithms are usually given, where they are given at all, as a sort of appendix to the ordinary tables, occupying not more than ten or fifteen pages, and leaving great gaps to be filled by interpolation. The interpolations are often intricate and tedious; and sometimes the plan is altered several times during the course of the table, so that the practical computer, after scratching his head repeatedly over the question of what plan is in use at any particular point, is apt to conclude in his haste that there is no economy of time in using these logarithms. But if he will only persevere until he becomes familiar with them, it is certain that he will "first endure, then pity, then embrace." Professor Hoüel thinks that the use of these logarithms cuts down by one-third the time required to deal with a binomial expression. This saving of time is greater yet if the table used is one that requires no interpolation.

Such a table is the one from which an extract is given below. Its use can be best shown by an example. Suppose we have $\log a = .45315$ and $\log b = .34182$, and desire to find $\log (a + b)$. From $\log a$ subtract $\log b$, giving .11133, and with this difference enter the column headed D_s. Take out from the adjoining column the correction $A = .24892$, and add it to $\log a$. This gives $\log (a + b)$. Or, if we have $\log a = .70197$, and $\log b = .34182$, and wish to find $\log (a - b)$, subtract as before, giving the difference .36015. Call this difference D_s, and enter the D_s column with it. Take out from the adjoining column the correction $S = .24900$, and subtract this from $\log a$. This gives $\log (a - b)$.

Some practical examples may be given.

Example 1. If the legs of a right-angled triangle are 78.69 and 69.23, what is the hypothenuse?

$$\text{Hyp.} = \sqrt{(78.69)^2 + (69.23)^2}$$

	Logs	*Logs*	
78.69	1.89592		
$(78.69)^2$		3.79184	
69.23	1.84029		
$(69.23)^2$		3.68058	
		.11126	D_s
		.24895	A
$(\text{hyp.})^2$		4.04079	
hyp.	2.02039		

$\therefore$ Hypothenuse=104.81

Example 2. Suppose the declination of the sun is 19° 21′ N., the hour angle is 4ʰ25ᵐ12ˢ (66°18′), and the latitude by account is 41°32′N. Required the calculated altitude for the purpose of fixing the position line.

The formula is sin (alt.) = cos (hr. angle) cos (lat.) cos (dec.) + sin (lat.) sin (dec.)

Hour angle, 66°18′,	cos, 9.60417		
Latitude, 41°32′,	cos, 9.87423	sin, 9.82155	
Declination, 19°21′,	cos, 9.97475	sin, 9.52027	
	9.45315	9.34182	
	9.34182		
	.11133	*Da*	
	.24892	A	
Altitude, 30°14′.2,	sin, 9.70207		

Example 3. Suppose the declination of the sun to be 19°21′N., the hour angle, 2ʰ58ᵐ8ˢ (44°32′), and the latitude by account, 41°32′S. Required the calculated altitude.

The latitude here being negative, cos (—lat.) = cos (lat.), and sin (—lat.) = — sin (lat.). Hence the last term of the equation becomes minus, and subtraction-logarithms are to be used.

Hour angle, 44°32′,	cos, 9.85299		
Latitude, 41°32′,	cos, 9.87423	sin, 9.82155 (*n*)	
Declination, 19°21′,	cos, 9.97475	sin, 9.52027	
	9.70197	9.34182 (*n*)	
	9.34182		
	.36015	*Ds*	
	.24900	S	
Altitude,	16°20.1′ sin, 9.45297		

So great is the saving of time brought about by the use of addition-subtraction logarithms that if the computer employs four-place tables for the calculation of the position line (and four-place tables are entirely sufficient for the purposes of navigation), he will find the above method about as short in point of time as any of the special abbreviated methods; and he will find it necessarily more accurate. Indeed, one of the great merits of these logarithms is the increased accuracy in the results obtained. This arises from the fact that throughout almost the entire range of the table, the argument and function vary *pari passu*, and hence the result is more accurate for the same reason that makes the tangent or cotangent preferable in calculating angles.

There are other advantages in using addition-subtraction logarithms. With a table of these logarithms, the computer hardly needs more than two or three equations out of all the great array given by spherical trigonometry. He will not need either to transform a formula to adapt it to logarithmic calculation, or to use auxiliary angles for that purpose. He will not be obliged to rearrange his data, or to compute intermediate functions which serve no purpose save to enable ordinary logarithms to be utilized. He will have no occasion to cut up his spherical triangle into right-angled triangles, in order to get the benefit of Napier's rules. At every step he can see just what he is doing, and can allow more easily for varying algebraic signs of trigonometric functions in different quadrants.

No computer who has once used addition-subtraction logarithms will ever be willing to go back to cumbrous tables of haversines, intricate and clumsy formulas (such as Napier's analogies) designed to give a logarithmic shape to other formulas, or roundabout substitutions of auxiliary angles for the same purpose. He will take his primary formula, put in his data, turn the crank, and grind out his result, without having to give any thought to the intermediate steps. Speed and accuracy in calculation are in direct proportion to the degree that it becomes mechanical; and the best way of making it mechanical is to follow in all cases a single uniform procedure, based upon the universal rules of elementary mathematics.

EXTRACT FROM TABLE OF ADDITION-SUBTRACTION LOGARITHMS

D_a	A S	D_s
0.11092–3	0.24910	0.36002–3
094–5	909	004
096–8	908	005
099–100	907	006
101–2	906	007–8
103–4	905	009
105–7	904	010
108–9	903	011–2
110–1	902	013
112–4	901	014
0.11115–6	0.24900	0.36015
117–8	899	016–7
119–21	898	018
122–3	897	019
124–5	896	020–1
126–7	895	022
128–30	894	023
131–2	893	024
133–4	892	025–6
135–7	891	027
0.11138–9	0.24890	0.36028

PYROMETRY APPLIED TO SUBMARINE DIESEL ENGINES

By Lieutenant E. B. Perry, U. S. Navy

ONE of the greatest problems confronting the marine Diesel engine operator is the getting and maintaining a balance of the work in the cylinders of his engines. The engine, as a whole, may be delivering its rated horsepower. That is not enough. Each cylinder must deliver its proportionate share of the total horsepower.

As an example, an 8-cylinder engine rated at 800 horsepower may be delivering 800 horsepower. Were we able to check each individual cylinder we might find the work split up in some such manner as this:

Cylinder number	*Horsepower being developed*
1	100
2	80
3	125
4	135
5	60
6	110
7	70
8	120
Total	800

Such a condition leaves much to be desired. If the engine has been properly rated, cylinders numbers 3, 4, 6, and 8 are overloaded while cylinders numbers 2, 5, and 7 are not doing their share of the work of the engine. Such operation does not promote economy nor long life of the engine. It introduces undesirable stresses.

There are several methods in common use for obtaining the relative amount of work delivered by each individual cylinder. The most familiar of these methods is that of taking indicator cards of each, determining the work of each and then equalizing the various cylinders until the cards show that each is contributing its rightful share of the total power of the engine.

In the case of a multiple cylinder engine, the taking of several complete sets of simultaneous indicator cards becomes quite a chore. When such a job is undertaken on a submarine type high-speed engine, with its notoriously poor indicator gear, rolling and pitching at sea, it becomes practically impossible. Sometimes cards are obtained but their value is questionable.

A second method of arriving at a balance of the engine, applicable to Diesel engines driving electric generators, is to cut out each cylinder successively, one at a time, and note the drop in the amperage generated. This method may be used on a submarine during a charge. The fuel is then adjusted at each cylinder until there is an equal drop in the charging rate as each cylinder is cut out. This method is practical but lacks flexibility, requires several men, and does not appeal to the engineering mind as being particularly attractive.

A third method is that of balancing the various cylinders by means of the heat of the exhaust gases. Each cylinder is adjusted until the heat of the exhaust gases are all equal. This method can be made very flexible, rapid, and accurate, and may be used at any time that the engines are operating. It is independent of the speed of the engine. It does require some means of measuring the heat of the exhaust gases which shall be positive, convenient, and rapid.

Heat may be measured by several methods, the most common of which are:

(a) *Mercury thermometers,* at the point where the heat is generated, in ranges from −38° to +1500°F.

(b) *Electrical resistance* method, where the change of resistance of certain metals due to heat is utilized. This method may be used in ranges from −400° to +2200°F.

(c) *Mechanical thermometers,* at the point where the heat is generated, by means of the expansion of two rods, having different rates of expansion which actuate a system to indicate the temperature. May be used in temperature ranges from +300° to + 1000°F.

(d) *Radiation,* in which temperature is

measured by the intensity of the radiant energy emitted, in ranges from +300° to +4000°F.

(e) *Optical* methods, where comparison is made with a known standard. Used in ranges from +1100°F. upwards.

(f) *Seger cones,* which melt at a definite temperature, in ranges from +1100° to +3600°F.

(g) *Thermo-couples,* or *pyrometers,* which depend upon the fact that two dissimilar metals, joined at one end and subjected to heat, will generate an electromotive force. Pyrometers may be used in ranges from –400° to +3500°F.

For the measurement of the exhaust gases in a marine Diesel engine, thermometers are not desirable. They stick out like sore thumbs, and like sore thumbs they are always in the way. They must be located at the source of the heat. The reading of them is a slow and tedious process, subject to personal and stem correction errors. In that they must be placed at the source of the heat, they are generally quite inaccessible.

Similarly, mechanical thermometers are unsatisfactory and, due to the vibration of the engine, they are thoroughly impractical.

It is quite obvious that the radiation, optical, and cone methods may not be conveniently used in a Diesel engine installation. The electrical change in resistance method has possibilities but savors too much of a laboratory test to be considered as desirable for constant use by the operating personnel.

This leaves the thermo-couple, or pyrometer method, which is practical, simple, speedy, and reliable provided that a few simple precautions are taken in the design, installation, and operation of the instrument.

In its simplest sense, a pyrometer installation consists of a "couple" or hot-end, connection or extension leads, and an indicating instrument. The hot-end is made up of two dissimilar wires joined together at one end. When this junction is exposed to heat, an electromotive force is generated in the couple, the electromotive force increasing with the heat. This electromotive force, or voltage, is impressed across the terminals of an instrument, usually a millivoltmeter which is calibrated to indicate in degrees of temperature. The connecting or extension leads, usually of similar metals to that of the couples, electrically connect the hot-end to the indicating instrument. For the convenience and economy of quickly connecting many hot-ends to one indicating instrument, a selective switch with leads to many hot-ends is generally placed in the circuit next to the indicating instrument.

The couples themselves are divided into two great classes: (a) noble metal couples and (b) base metal couples. Noble metal couples are generally formed of small wires of platinum and an alloy of platinum and rhodium and are known as the "high resistance type." This type of couple is expensive, rather fragile and generates a very small voltage, approximately .005 per degree F. Base metal couples are made of many metal combinations, such as chromel-alumel, chromel-copel, iron-constantan, and copper-constantan. They are inexpensive, strong, durable, and develop a comparatively high millivoltage. The base metal couple is the one commonly found in marine Diesel engine practice.

The couples, or hot-ends, to perform their functions of measuring the heat of the hot gases, must be installed where they will be

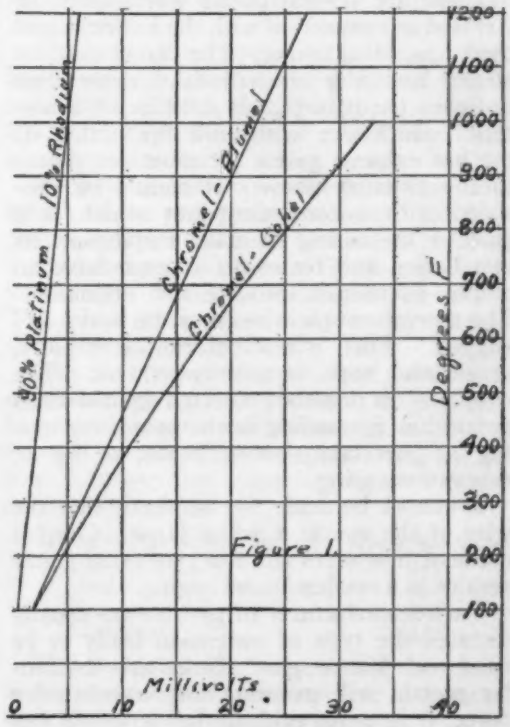


Figure 1.

FIG. 1

acted upon by the hot gases as soon as they shall have left the combustion spaces. The most convenient and logical place is usually the exhaust elbow, the first piping which receives the exhaust gases.

Some means of supporting and a protecting device are needed to hold the couples in place and protect them from mechanical and chemical injury by the hot gases. The sketch, Fig. 2, shows a convenient and conventional method of installation and protection.

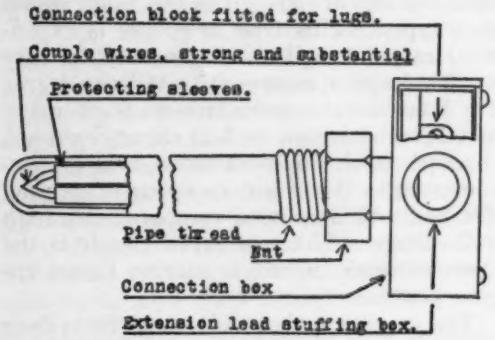


FIG. 2

There are several points which must be stressed in connection with the hot-ends and their protecting casing. The casing must be strong and able to withstand more than ordinary hard usage. It must be of a material which can withstand the action of the hot exhaust gases. It must not *freeze* to the exhaust elbow. It should be provided with a convenient nut which is a part of the casing to make convenient its installation and removal. It must have an ample connection box, easily accessible. The thermo-couple wires must be heavy and rugged. Fine wires deteriorate rapidly, break and soon become worthless. The couple wires must be protected against short circuit and grounding in the protecting casing by porcelain sleeves, beads, or by an asbestos covering.

It cannot be made too emphatic that the wire of the couple must be large. Couples made of fine wires will not give satisfactory service in a marine Diesel engine.

Each manufacturer of pyrometers usually dictates the type of extension leads to be used with his couples. Since any dissimilar metals will generate an electromotive force, it is quite evident that it would not be good practice to use an iron-constantan couple and then install iron wires for both sides of the extension leads. Instead of one couple at the hot-end junction, there would be three couples, each generating a small voltage; one at the true hot-end, one at the junction of the constantan wire of the couple and the extension lead and a third at the junction of the iron wire of the couple and the iron lead wire, unless the wire of the couple and that of the extension lead happened to be of similar composition. Therefore it behooves one to use the extension leads recommended by the manufacturer.

Further, there is the question of the resistance of the extension leads. Some manufacturers insist upon equal lengths of lead for all couples connected to one millivoltmeter. Others use a wire of such low resistance that little differences in lengths do not matter. Others use high resistance millivoltmeters in which case the comparatively small resistance of the leads is of little importance.

The indicating instrument is ordinarily a millivoltmeter. The deflection of the needle is proportional to the current flowing through the coil of the meter. The current which flows is proportional to the electromotive force generated in the hot-end and, hence, to the temperature. As stated above, these instruments may be either high or low resistance instruments. In the low resistance type, a small current will cause a large deflection. This type of meter may be built very rugged. Bearing friction is not a matter of great importance. With this type of instrument the resistance of the extension leads must be allowed for and no alteration in them is permissible without a new calibration.

The so-called high resistance instrument has a high resistance unit in series with the movable coil. The resistance is purposely made high so that the resistances of the hot-ends, extension leads, and selective switch are negligible compared with that of the instrument. This instrument must have jeweled bearings and a moving element of high order, necessitated by the small current that passes through the coil. This type of meter, while rather fragile, has the advantages of allowing interchange of hot-ends of the same characteristics and that practically no error is introduced by changes in the lengths of the extension leads.

Reverting to the hot-ends, it should be realized that the voltage generated in the couples is dependent upon the difference in temperature of the joined end of the two wires known as the *hot*-end and some other point known as the *cold*-end. When extension leads of similar metal to the metal of the couples is used, the cold-end is transferred to the meter. Most millivoltmeters are equipped with an adjustment for setting the needle so that it corresponds with the room temperature, thus making the meter direct reading.

So much for the equipment—now for the installation. The meter should be firmly mounted where it will be as free from vibration as is possible. It should be so located that it can be easily read, preferably at the height of a man's eyes. In close proximity should be mounted the selective switch. The extension leads to the various cylinders should be well supported at short intervals and not left looped and hanging loose. The protecting casings should be securely screwed into the exhaust line fitting but should not be forced in. It may be desirable to remove them some time. All connections should be carefully made; loose contacts with such extremely low voltage are fatal to successful operation. Lugs on the extension leads are very desirable.

A pyrometer system is only as good as its accuracy. That accuracy must not be taken for granted; the system must be checked and calibrated occasionally as a matter of routine. The process of calibrating such a system is not nearly so mysterious as it is sometimes thought to be. There is needed only the following: An iron pot; a source of heat, such as a good blow torch; a few pounds each of pure tin, lead, zinc, and aluminum; stop watch; cross-section paper and pencil.

To check one unit, the pot is heated and the block of pure tin is melted therein. When the tin becomes all liquid, the couple to be checked, in its protecting tube, is thrust into the molten tin. The pot of molten tin is removed from the source of heat and then a curve of temperature indications, as shown by the millivoltmeter, versus time, as shown by the stop watch, is plotted, readings being taken every thirty seconds. As the tin cools the curve will be similar to that shown in Fig. 3 for Sn.

Pure tin "freezes" or changes from liquid

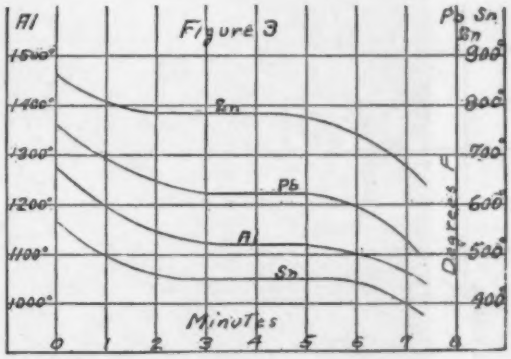


FIG. 3

to all solid at 449.4°F. This point will show up on the curve as a flat spot. Nature, being naturally pig-headed, resists the solidifying of the tin. This resisting temperature, if we may call it such, will stay constant for an appreciable length of time. During this period, in order to be certain to catch the right point, it is advisable to plot the curve at fifteen second intervals. If the meter reads 445°F. at the point where the curve shows that the tin is changing from the liquid to the solid state—freezing—then the meter reads 449.4-445.0=4.4°F. low at that temperature.

Similar curves are run for lead, zinc, and aluminum, the freezing points of which are: lead, 621.3°; zinc, 786.9°; aluminum, 1217.7°. Typical curves for lead, zinc, and aluminum are shown in Fig. 3.

In making the above check, a standard length of the proper extension lead for that particular system should be used to connect the hot-end to the meter. This is especially necessary with the low resistance type meter. The selective switch, if used in the system, should be in the circuit.

The four points for tin, lead, zinc, and aluminum having been obtained, they should be plotted to get a calibration curve for the hot-end tested. Such a plot is shown in Fig. 4, using the following figures as an example:

At solidifying point of	*Meter indicated*
Tin	445°
Lead	620°
Zinc	790°
Aluminum	1220°

The indicated readings should be close to the true temperatures; an error of greater than 5 degrees should be investigated. If one or two of the hot-ends do not come

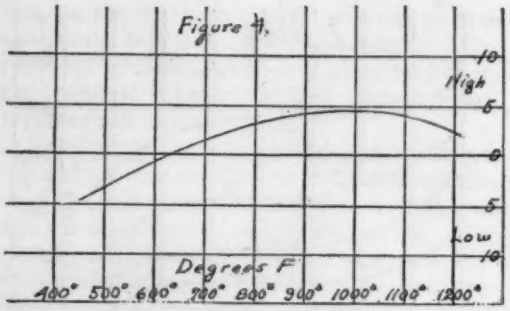


FIG. 4

close to the temperatures as given by the solidifying points of the metal while all of the other hot-ends do, investigate the two hot-ends that do not check. If many of the hot-ends do not check, suspect the purity of your tin, lead, zinc, and aluminum. Being assured of their purity, investigate the meter for bearing trouble, loose contacts, and mechanical interference in the moving element. The main thing is to get all of the hot-ends indicating alike at the same temperatures. The meter may then be calibrated to suit the hot-ends.

If any considerable trouble is encountered with the above test, a more complete test, and one which navy yards should invariably follow, is to perform the above experiment substituting a means for reading the millivolts generated in place of the heat as shown by the meter. The four points of temperature, as determined either by the freezing points of tin, lead, zinc, and aluminum, or by comparison with a laboratory standard, and the millivolts generated at those points will give a curve which should check with that furnished by the manufacturer of the pyrometer system. The meter, itself, may then be calibrated by the use of a potentiometer, impressing a known voltage across the meter to obtain certain readings, as shown by the curve.

As an example of the above, if the curve furnished by the manufacturer were similar to the one shown in Fig. 1 for chromel-alumel, a hot-end at the freezing point of tin should develop 9.7 millivolts. Similarly, if 20 millivolts be impressed across the system, the meter should read 890°F.

In checking both the hot-ends and the meter, an extension lead should be used to connect the unit tested and the instrument used in making the test.

Routine checking of the system is very desirable. A pyrometer is an instrument and must be treated as such.

Is the pyrometer worth the pains of keeping it in condition? Decidedly yes. It is the best, most accurate, quickest, and simplest method we have of determining what each cylinder is doing. By obtaining power spots at various propeller revolutions and then running the engines at these speeds, records of exhaust temperatures at various horsepowers may be obtained. Such records would be well worth while in themselves. Their use might eliminate cracked cylinder heads while trying to run a full power run into a stiff head sea.

In thinking of pyrometers, the points to be remembered are:

(A) To select a good pyrometer, making certain to get a generous-sized wire for the couples; good, sturdy protecting casings with readily accessible connection boxes; proper connecting leads for the particular system to be used and a meter rugged enough to stand the abuse it necessarily must receive.

(B) To make a workmanlike job of the installation, being certain that all parts are securely fastened and all connections are tight.

(C) To check the accuracy of the system as a matter of routine.

(D) That the system is installed to be of use. Use it and profit thereby.

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

CHARGING FLOOR OPEN-HEARTH BUILDING, LOOKING EAST, U. S. ARMOR PLATE PLANT

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

LOOKING NORTHEAST FROM RAILROAD GATE

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

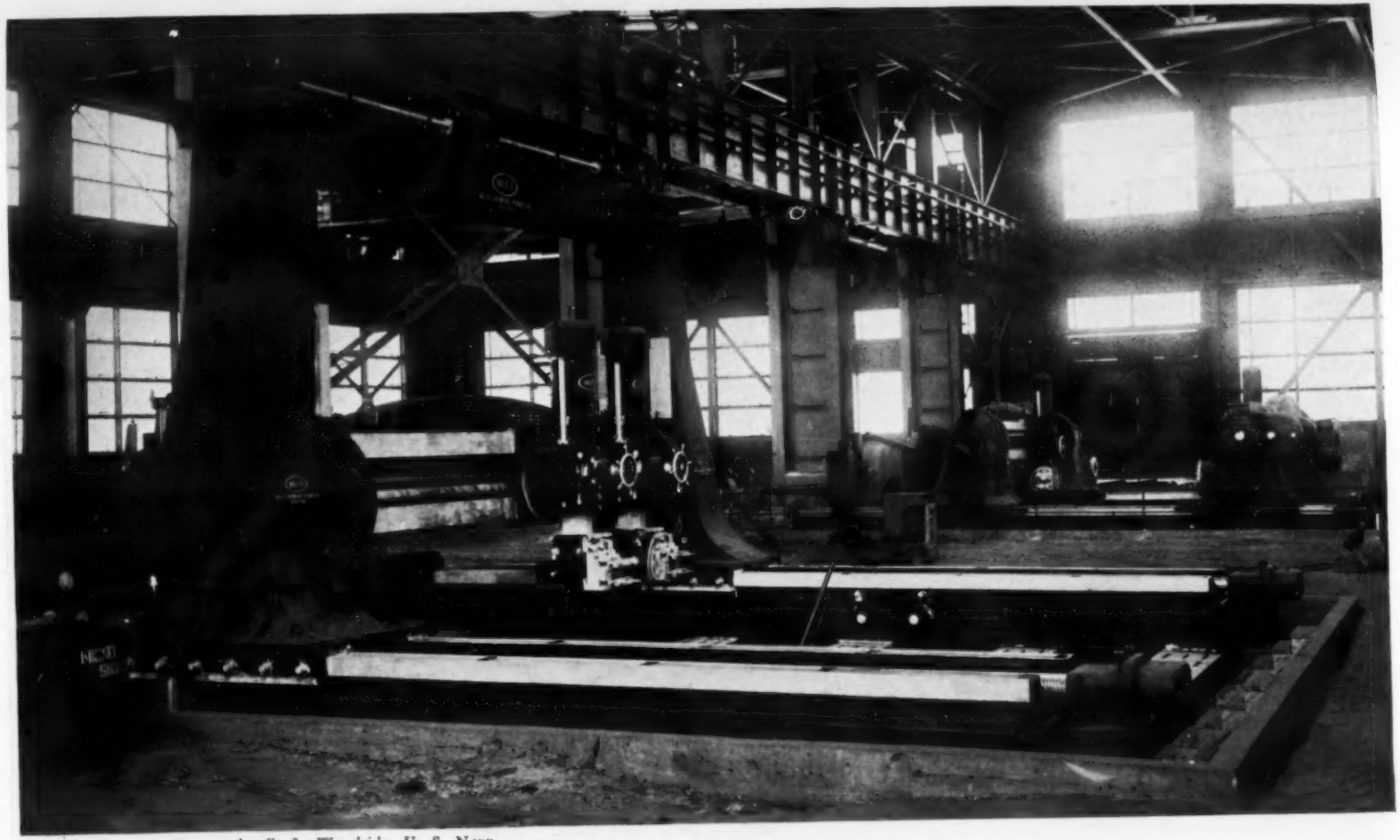
OFFICERS' QUARTERS AND PART OF ARMOR PARK

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

GREAT GUN MACHINE SHOP SHOWING SOME OF THE GREAT BORING MILLS AND TURNING LATHES

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

GREAT GUN MACHINE SHOP SHOWING SOME OF THE GREAT BORING MILLS AND TURNING LATHES



Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

SHOWING TWO TYPES OF HEAVY-DUTY ARMOR-PLATE PLANERS

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

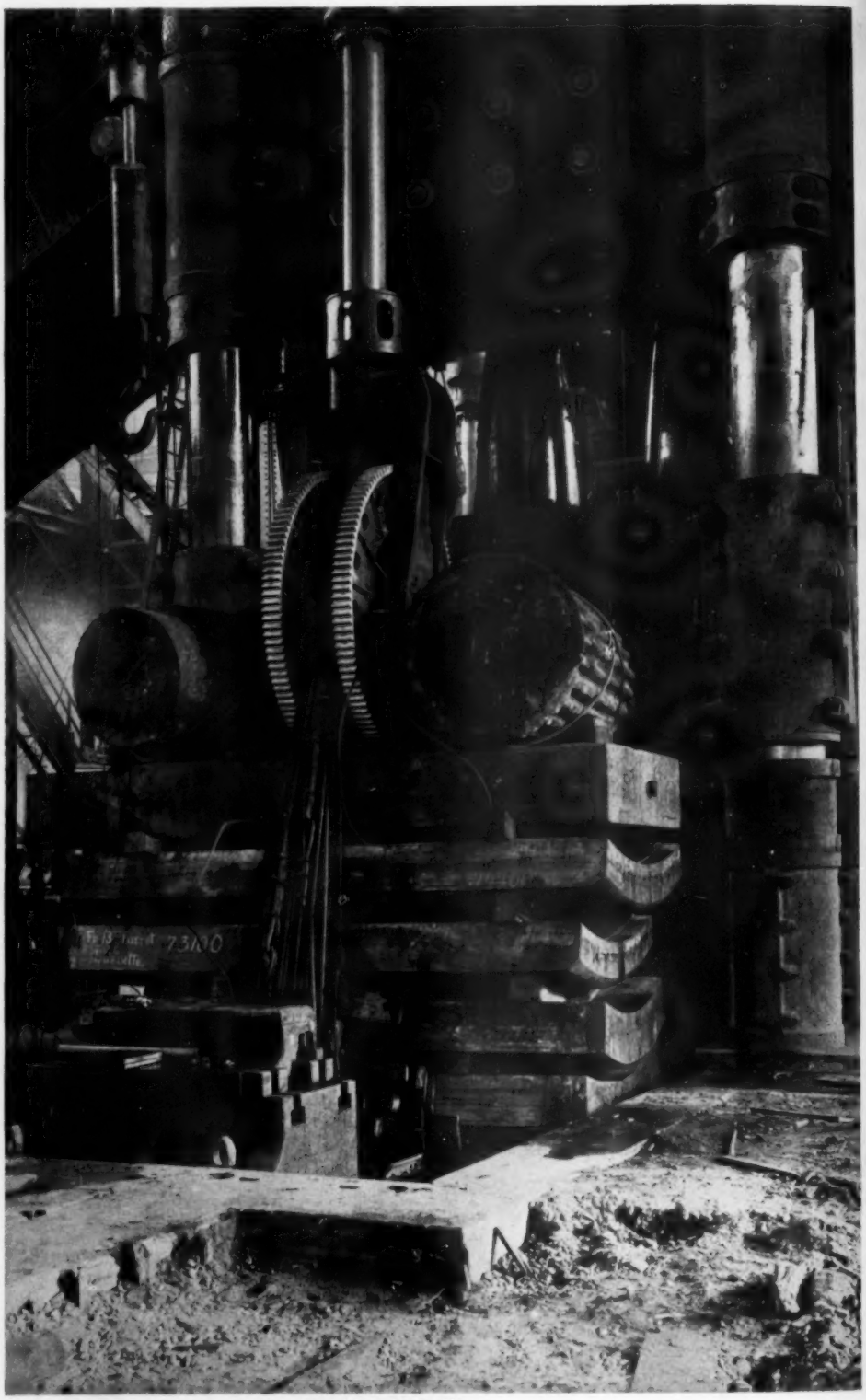
PART OF THE GUN BAY, NORTH UNIT MACHINE SHOP

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

PART OF THE GUN BAY, NORTH UNIT MACHINE SHOP

Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

PROJECTILE BAY OF NORTH UNIT MACHINE SHOP



Courtesy Lieutenant Commander E. L. Woodside, U. S. Navy

TEST LOAD OF 260 TONS LIFTED BY 250-TON ELECTRIC HYDRAULIC FORGING CRANE AT NORTH SIDE OF 14,000-TON PRESS

THE NAVAL ORDNANCE PLANT

By Lieutenant Commander E. L. Woodside, U. S. Navy

Editor's Note: Since this article was written in August, 1930, a new policy has been directed by the Secretary of the Navy whereby much of the equipment of the plant is made available for transfer to other naval activities.

MANY people in and out of the naval service are aware of the existence of a Naval Ordnance Plant at South Charleston, West Virginia, but it is not surprising if relatively few know anything more about this plant than that it exists. As a matter of fact that is all it does just now.

In 1916 and 1917, when the Navy was diligently building battleships and their necessary big guns, it was decided that a real need existed for a government-owned plant where armor plate, heavy-gun forgings, and projectiles could be manufactured, independently of the commercial producers. Accordingly authority was granted by Congress in the act of August 29, 1916, the necessary appropriations made, and work was started on August 30, 1917, on the construction of a steel plant capable of supplying the Navy's needs in armor, big-gun, and projectile forgings.

All of the factors which influenced the selection of South Charleston, West Virginia, as the site for the proposed plant cannot be discussed here, but we may just mention a few, such as security from enemy attack from the coast, abundance of fuel—both natural gas and coal—abundant supply of electric power, a plentiful supply of water from the Kanawha River, and splendid transportation facilities, such as the Chesapeake and Ohio Railroad, the New York Central Railroad, and the Kanawha River. Also an important factor was that the site comprising about 210 acres of land was, for the most part, donated by the people of Charleston.

A main east-west highway across the state, through the mountains, called the Midland Trail, passes directly through the reservation, dividing it into two sections known as the north unit (between the highway and the river) and the south unit (between the highway and the Chesapeake and Ohio Railroad tracks). While there is a small electric furnace, two foundry cupolas for cast iron, and a small non-ferrous furnace in the north unit, both units are dependent for their ingots upon the output of the open-hearth furnace building in the south unit. This building contains two 75-ton (rated capacity) open-hearth, gas-fired furnaces, two 40-ton and two 6-ton Heroult electric furnaces, and one 1-ton Heroult experimental furnace. In other respects, that is with regard to forging, heat-treating, and machining operations, the two units are really two separate and distinct plants, the north unit handling all small work such as projectiles (3 to 18-inch caliber), torpedo air flasks, and guns up to 6-inch caliber. The south unit is designed to produce heavy armor plate and major caliber gun forgings.

The construction work was so planned that by the middle of 1918 the north unit was put on a production basis and proceeded with the manufacture of projectiles, torpedo air flasks, and small gun forgings. The effort to complete the north unit delayed construction of the south unit until October 1, 1918, but then this work was pushed rapidly while the north unit continued to produce war material. In the south unit, the open-hearth furnace building was the first to be completed, and as fast as buildings and equipment were installed they were put to work on production.

The designs used in the construction of the plant were carefully developed, and incorporated all of the most up-to-date ideas of the steel industry. Ample space was available, and no existing installations had to be considered to handicap the designers, with the result that at present the layout of the buildings and equipment is ideal. The buildings are all roomy, well ventilated, and well lighted, completely served by overhead

traveling cranes, and are constructed of steel, hollow tile, and brick, built to stand for years.

It is hard to give, in the short space available, a comprehensive picture of the magnitude of the plant, the efficient layout of the buildings and equipment, and the excellent condition of the machinery. Perhaps a general idea of the plant may be conveyed by a rough description of the more important buildings. First, then, is the open-hearth furnace building, 516 feet by 225 feet, of steel and hollow tile. This has a capacity of 150 tons of steel ingots daily, produced by a Duplex Process which permits production of the highest quality steel and steel of almost any characteristics. Then comes the forge and furnace building, of steel and hollow tile construction, built in the form of a huge letter "H," a radical departure from the design of shops of its kind previously in existence. The over-all dimensions of the building are 644 feet by 477 feet. Each leg of the "H" is equipped with large gas-fired, car-bottom furnaces, and served by two 100-foot span traveling cranes, one of 100-ton and one of 200-ton capacity in each wing. In the center cross of the "H" is a 14,000-ton Mesta forging press, one of the largest of its kind known. There is also the foundation for a 6,500-ton press, all the parts of which are in the shop but not erected. There are in all twenty-two furnaces (including a gun annealing furnace), a scaling machine, a large boring mill, a slicing lathe, and an armor spray pit in this building.

Next, north of the forge and furnace building is the boiler house with a battery of eight Stirling boilers of a combined capacity of 6,500 horsepower. Nearby is the electric substation where the incoming electric current at 66,000 volts is stepped down to usable voltages, and converted to D.C. as necessary for use in the various parts of the reservation.

North of these two buildings is the only unfinished building of the group, the high gun treatment building, one end of which is over 150 feet high, with a deep concrete-lined pit under this portion to contain the vertical heat treatment furnaces and quenching tanks. The high portion of the building is fitted with a 75-ton traveling crane, while the total lifting height from floor of pit to crane is about 220 feet. The equipment for the low portion of the building, such as two 75-ton traveling cranes, two 60-inch cold saws, one 60-inch slotter, and one 3,000-ton straightening press, is on hand but not installed.

The next building is the armor plate and great gun machine shop, a structure of steel and hollow tile, 552 feet by 319.5 feet. There are three aisles running lengthwise of the building, in each of which are two 100-foot span traveling cranes (altogether two 150-ton cranes and four 75-ton cranes) serving numerous large planers, boring and drilling machines, an erecting floor 85 feet by 48 feet of adjustable surface plates, and tremendous boring and turning lathes.

This south unit also includes several other buidings, such as an adequate administration building, laboratory, storehouse, pattern shop, blacksmith shop, and tool treatment room whose equipment would gladden the heart of the most exacting workman, a roundhouse and maintenance shop, etc., and there is also a reservoir 350 feet by 750 feet by about 30 feet deep, capable of holding fifteen million gallons of water.

In the north unit there are three main buildings, all of steel and hollow-tile construction. The melt and forge shop is about 565 feet by 138 feet and contains equipment for making steel, iron, and brass castings, seven gas and oil-fired forge furnaces, four car-bottom annealing furnaces, three forge furnaces for 6-inch gun forgings, one 3,000-ton hydraulic forging press, one 500-ton press, and a 6-inch, 53-caliber, vertical, gun-treatment furnace and quenching tank. The heat treatment building is fully equipped to handle projectiles. The machine shop building, of steel and hollow-tile construction, 410 feet by 140 feet, really includes three fully equipped shops, namely, the minor caliber gun shop, the projectile shop, and the tool and miscellaneous shop. Its layout and equipment would be a joy to any machine shop superintendent.

These are roughly the industrial parts of the plant. The reservation contains also six substantial homes for officers and the machine superintendent, sixty-five stucco houses (eighty-five homes), and a schoolhouse erected by the U. S. Housing Corporation and later turned over to the Navy Department, and thirty-two bungalows erected by the Navy to house employees of the plant.

The above description is necessary to a proper appreciation of the problem confronting the Navy Department at the present time. It will help toward an understanding of the figure we find for the total investment by the government in this project—close to $30,000,000. To show for this outlay, the Navy now has a steel plant capable of producing as much as 50,000 tons of steel (properly proportioned as to kinds) per year.

Now let us consider the existing problem which this plant presents. As was stated before, the north unit was in a production status about the middle of 1918 (the first ingot was poured June 8, 1918) and later the armor plant and great gun shop was working on several orders before the plant was closed in February, 1922. A synopsis of the production period of the plant shows the following as some of the items that were completed and shipped from this station:

Item	*No. shipped*
6" Gun liners	181
6" Tubes	194
6" Jackets	188
6" C1 hoops	194
6" C2 hoops	195
6" Locking rings	197
6" Mushrooms	274
6" Breech blocks	247
6" Screw box liners	255
6" Gas check rings	819
5" AA tubes	3
6" Monoblock tubes	2
BB Armor bolts and nuts	58,333
CC Armor bolts	548
16" Gun B4 hoop	1
16" Gun B5 locking ring	1
16" Counter recoil cylinders	306
16" Counter recoil heads	313
16" Mushrooms	50
16" Breech blocks	50
16" Screw box liners	45
16" Gas check rings	240
16" A.P. projectiles, complete	242
18" Target projectile, type A	4
18" Target projectile, type B	2
18" Target projectile, type C	5
21" Torpedo air flasks	41

In February, 1922, following the Washington arms conference, the order was received to cease all work, and since then the plant has been maintained in an inactive status, the buildings, grounds, and equipment being maintained in such a condition that, should a decision be made to resume work, production could be started with a minimum loss of time.

There are four courses of action, or policies, open to the government with respect to this plant, namely:

(1) Maintain it in its present inoperative status, ready for quick resumption of work.

(2) Lock up everything, maintaining only a marine guard to prevent theft.

(3) Operate such portions of the plant as would be necessary to supply the Navy with its peace-time needs of steel.

(4) Sell the plant to commercial industry.

The first of these policies is the one that has obtained during the past eight years. Periodic overhaul and operation of machinery has resulted in all machines being in working condition and exactly as good as they were the day the plant was closed. Some of the heavy machines in the armor and great gun machine shop are therefore practically new. The valuation placed upon the plant by the Bureau of Supplies and Accounts as of June 30, 1930 ($7,794,806.96), does not give a true picture of conditions. In arriving at that figure the standard depreciation tables were followed, but these are applicable to buildings and equipment in constant use, whereas the material here, not having been used in eight years, should show the same value as it had in 1922 less only a small depreciation due to obsolescence of type. Therefore, the real value is more nearly $18,000,000.

True, this policy is now costing the Navy Department about $155,000 a year ($140,000 borne by the Bureau of Ordnance, about $15,000 by the Bureau of Supplies and Accounts) exclusive of pay of officers and enlisted men. While the pay of Navy and Marine Corps personnel may be chargeable to the expense of the plant, it is a question whether this should be charged directly, since that pay would go on regardless of the station. It is more properly a charge against the cost of the Navy as a whole. To offset the costs against the plant it is fair to consider that about $40,000 a year is turned back into the treasury as proceeds from the rentals of houses in the community. But the Navy Department gets little credit for this return and must spend about $155,000 per year for upkeep. The question has often been raised as to whether or not this is too great an expenditure, but should the dark clouds of a major war descend upon our country, there would be not the slightest doubt of the tremendous value of the plant. The expenditures would then be forgotten.

Let us now turn to the second policy. It has cost the government over $125,000 a year in the plant proper to combat the ravages of weather and time. Without this policy in force it is safe to predict that within a very few years rust and deterioration would gain such a headway that the equipment would be reduced to junk and the buildings to a state of ruin, unsafe and unsuitable either as a Navy steel plant or for commercial purposes. The loss would be stupendous, practically $30,000,000.

With respect to the third policy, the peace-time needs of the Navy could absorb only a small portion of the capacity of the plant, but a recent study has been made to show the minimum economical production. The layout of the plant lends itself to such a production. By operating the electric furnaces only in the open-hearth furnace building, then carrying the ingots to the north unit which would be in full operation, it is believed that an economical operation could be developed, particularly if diversified orders could be obtained. Minor caliber guns, projectiles, torpedo air flasks, turbine rotors, engine shafts, and miscellaneous small parts could be produced, sufficient to supply the peace-time needs of the Navy both in ordnance and engineering; that is, provided these needs should amount to as much as 2,000 tons of finished material per year and that orders for at least three years of operation could be assured.

This brings us to the question of the "government in business," and volumes have been written on this subject. Because of the accounting methods used and the cost of rejections and experimentation incident to a newly operated plant it is doubtful if the government could produce steel products at less than their cost from commercial concerns within the first few years, but this cost is only one of several factors to be considered. One important factor is the training of commercial concerns to handle Navy demands. The argument has been advanced that if the Navy produces its own steel in peace time, then in war when industry's aid must be sought, it will be found unfamiliar with Navy needs, and much valuable time will be lost while the commercial companies are being trained to produce material to meet the Navy's standards.

We come now to the consideration of the fourth policy. Should a steel company purchase the plant, the company would get a bargain even at ten to fifteen million dollars. The plant is essentially a steel plant, and as shown by the foregoing description it is ideal as such. Of course a commercial steel company would have little need of the armor plate forge and machine shops or the high gun treatment building, but these could be converted. One wing of the big forge shop could be converted into a splendid rolling mill. With 210 acres of land available, there is ample room for expansion and for slag dumps for many years.

It may be that no steel company is interested now, and in that case the land and buildings should appeal to some other industry. There are many chemical industries in the vicinity, and the Kanawha valley bids fair to become the center of the chemical industry of the country. If the equipment of the buildings were sold, it alone should bring several million dollars. All in the south unit is practically new, and some of the machines are the finest and biggest in the country. The remaining buildings themselves would still be valuable to a commercial manufacturer.

Altogether, considering the investment by the government and the present condition of the material, the intrinsic value should be not less than $15,000,000. But seldom, in a sale of government war material, has anywhere near the intrinsic value been realized.

The sentiment is rapidly growing that the present policy is proving too expensive to the government, and the longer we dwell in peace with the prospects of war seeming more and more remote, the stronger will this sentiment become. Were there no other sources of supply of armor and great gun forgings, the war asset feature of the plant might influence a decision, as an economy measure, to lock up the buildings, leave a small guard to prevent pilfering, and trust to chance to combat the ravages of weather and time. But at one time several large steel companies were equipped, though perhaps not so well, to supply the Navy's needs, and it is believed that much of this equipment has been retained in a more or less available condition. With this condition it is believed it would be in serious conflict with true economy to just abandon this plant. Better far to spend the necessary money to keep the equipment in condition to demand a fair price in case it be decided to sell.

It is freely admitted that to operate the plant, even at a minimum capacity as outlined above, would be very costly for the first year or two until production could be balanced and stabilized. This cost is not in accord with the present economy program of the government. We therefore arrive at the conclusion that the logical policy is to sell the plant to industry. Among other considerations, this policy would undoubtedly meet with the hearty approval of the civilian populace, not only in the vicinity of Charleston, but in all of West Virginia. The people of the community, who contributed $310,741 for the land donated to the government, are anxious to see the property used actively, either by the government or by industry. If this policy be decided upon, it should be borne in mind that in its present condition the plant is very valuable, and no sacrifice price should be considered. The writer has heard of a figure of $1,000,000 being considered acceptable! Why, the machinery alone would be sacrified at twice such a ridiculously low figure! It would not be surprising if this question should be raised in the next session of Congress, with possibly just such a debate ensuing as has been heard in connection with the Muscle Shoals project. It is hoped, however, that a more prompt decision may be reached. Whatever the arguments, should the plant be sold, true economy must demand that the government receive a reasonable, fair price.

SOME ABC'S OF THE PROPELLER

By Commander H. F. D. Davis, U. S. Navy

SEAGOING men in general and naval personnel in particular should certainly have such clear ideas of how propellers work that necessary explanations can be made to inquisitive children or to prying landlubbers.

How does a propeller propel? Referring only to final effect, as the name suggests, the propeller pushes the ship horizontally against the resistance of the water. The airplane wing, while moving horizontally, develops "lift" to hold the airplane up against the downward pull of gravity. The "thrust" of the propeller and the "lift" of the airplane wing are therefore similar, the former acting to overcome the resistance of the water, the latter acting to overcome the pull of gravity. The action of the airplane wing being easier to understand, a partial explanation will first be given of the development of lift by the airplane wing.

In Fig. 1 an airplane wing is shown in section, side elevation. The plain arrow indicates the direction of motion; the feathered arrow shows the direction of the relative wind with which the chord of the wing section makes the angle α, the angle of incidence. It has been shown by experience and experiment that under these conditions an increase in pressure develops under the wing and a decrease in pressure develops above the wing with the result that there are produced a "lift" (L) "perpendicular to the direction of motion" which supports the weight of the plane, and a "drag" (D), opposite to the direction of motion which resists the forward motion. With so called airfoil sections the lift is ten or more times the drag. Airplane operations are now so common that the foregoing physical facts have become part of the experience of most people who have thought about this matter at all.

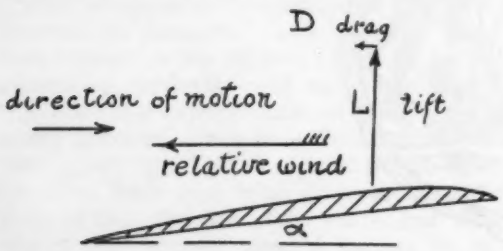


FIG. 1

Kutta and Joukowski early in this century developed a mathematical theory, agreeing very well with experimental work, to explain how under such circumstances a "circulation" is set up around the airplane wing which, acting with the relative wind, gives rise to the lift acting perpendicular to the direction of velocity. Readers interested in going into this theory are referred to *National Advisory Committee for Aëronautics Report No. 116.* For present purposes the fact that lift is developed may be accepted as an experimental fact.

Now consider the action of the ship propeller; Fig. 2 shows, in perspective, successive views of a propeller blade, supposed to be turning at a uniform rate and developing thrust, the Roman numerals I, II, and III indicating three positions of a section of the blade taken perpendicular to the radius and at distance r feet from the center line of the shaft which is turning at R revolutions per minute, while the shaft, propeller, and ship advance at v feet per minute through the water. At each marked position the instantaneous forward velocity v (ft/min), rotational velocity $2\pi\ r\ R$ (ft/min) and resultant velocity $vr = \sqrt{v^2 + (2\pi r R)^2}$ (ft/min), of the section under consideration, equal in each case, have been drawn. The feathered arrow shows that the relative water flow is equal and opposite to vr.

To make it easier to visualize the similarity of the action of the propeller to the action of the airplane wing, velocity diagrams for the sections as seen from above at position I of Fig. 2 have been redrawn in Fig. 3;

NOTATION

R = r.p.m.
r = radius to section.
V = ship's speed through water.
V_r = speed of section relative to the water.

$v_r = \sqrt{v^2 + (2\pi rR)^2}$

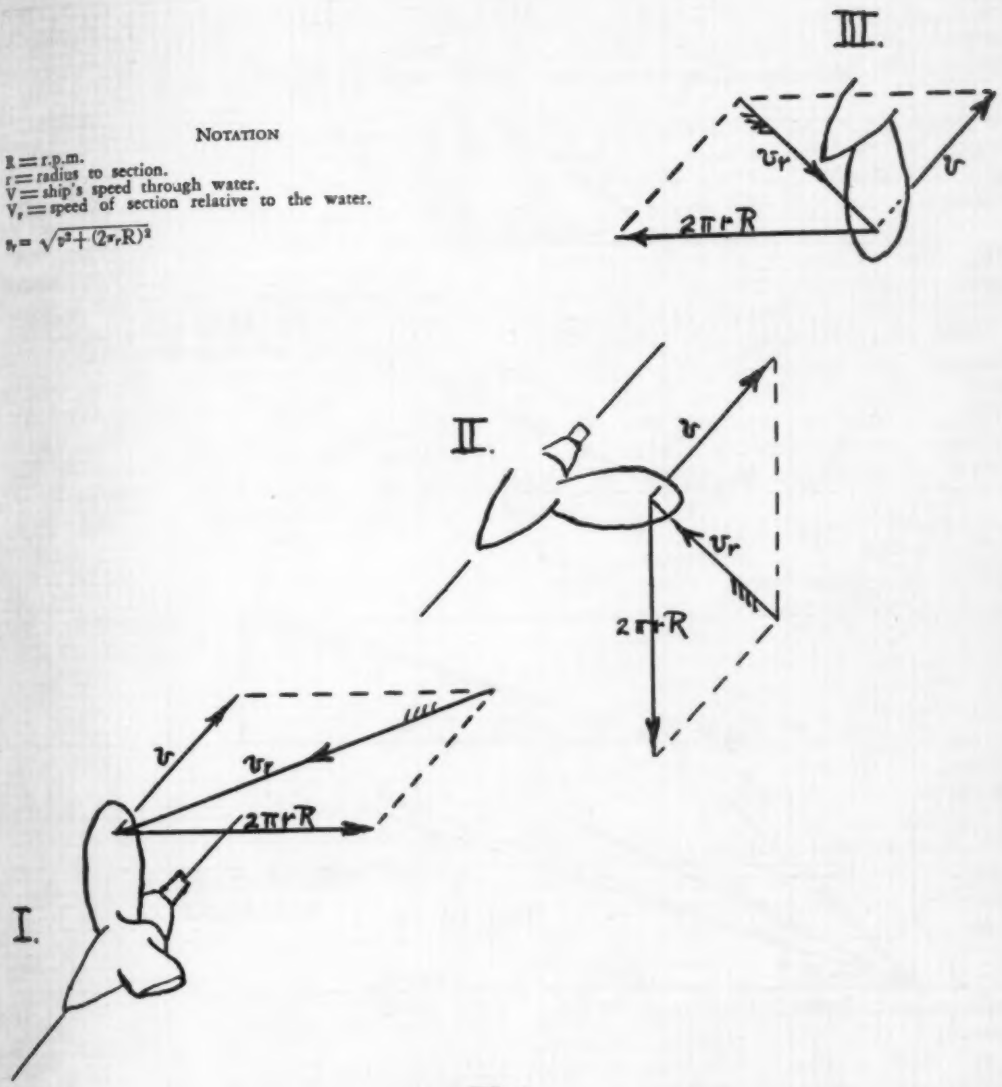


FIG. 2

at 3(a) it is assumed that the section is at 2 feet radius; at 3 (b) is shown a section of 4 feet radius and at 3 (c) one at 6 feet radius, drawn roughly to scale, representing the propeller of the U.S.S. *Tennessee*. It should, however, be noted that the blade section is not to scale.

To simplify this next step in explanation it is assumed that the water is undisturbed in front of the propeller. Seeking now the similarity of action to that of the airplane wing it is believed to be clear from the diagrams that the direction of the relative flow of water in each case is indicated by the feathered arrow; that the relative flow is opposite in direction and equal in amount to the resultant of the forward and rotational velocities of the sections of the propeller being considered; that α is the angle made by the chord (driving face) of the section with the relative flow and corresponds to the angle of attack α of the airplane, Fig. 1; and, as in the case of the airplane wing there will be a pressure exerted on the face of the propeller, a suction on the back, and a resultant force L perpendicular to the direction of motion; finally, now looking at the force diagram, Fig. 3(f), this force may

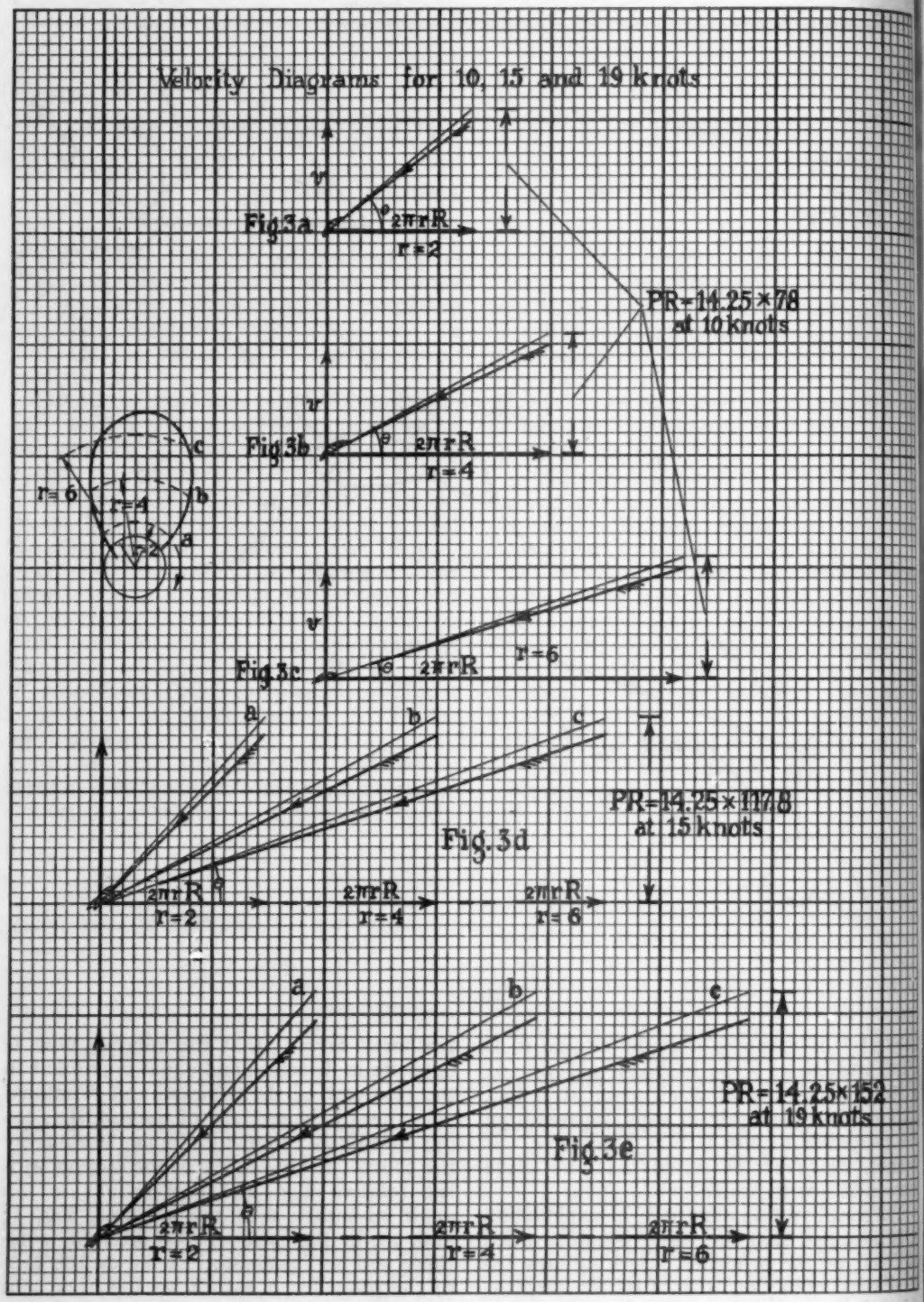

Velocity Diagrams for 10, 15 and 19 knots
Fig.3a
v
2πrR
r=2
V
PR=14.25×78
at 10 knots
Fig.3b
r
r=6
r=4
r=2
c
b
a
Fig.3c
v
2πrR
r=6
V
Fig.3d
a
b
c
PR=14.25×117.8
at 15 knots
2πrR
r=2
2πrR
r=4
2πrR
r=6
Fig.3e
PR=14.25×152
at 19 knots

FIG. 3. a, b, c, d, e

be resolved into a forward thrust to drive the ship and a twisting force which must be overcome by the turning force (torque) of the engine. The motion of the blade through the water will also give rise to a reaction *D*, corresponding to the drag of the airplane wing, which, resolved into components, parallel and perpendicular to the shaft, reduces the effective thrust and adds to the component which must be overcome by the torque of the engine. Finally the total effect of the propeller at any instant will of course be a summation of the simultaneous actions of all sections of all blades.

The angle θ in the diagram of Fig. 3 is the pitch angle, that is, the angle at which the section being considered stands relative to the athwartship line of the ship. When the nominal pitch, measured in feet, is uniform over the driving face, as in the case

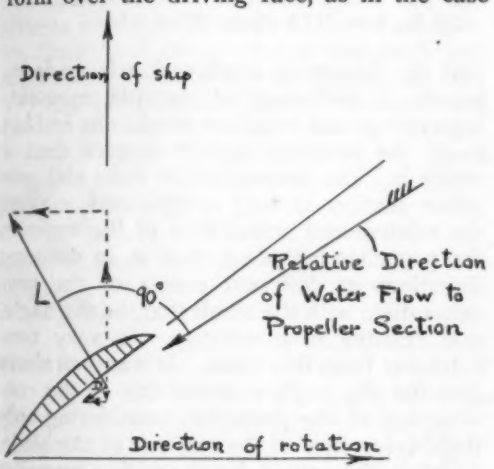


FIG. 3f. FORCE DIAGRAM

of the *Tennessee* propeller, as well as in practically all propellers used in the U. S. Navy, θ varies at each section as is clearly seen by comparison of the sections shown in Fig. 3 (a), (b), (c), (d), and (e).

The ratio $\frac{PR-v}{PR}$ in each diagram is called the apparent slip ratio; the angle α, which, as seen in Fig. 3, measures $(PR-v)$, is the apparent slip angle and corresponds to the angle of attack of the airplane wing.

In summarizing the foregoing explanation the following facts may be stated:

(a) The propeller develops thrust and requires torque to turn it due to its many blade sections, each being at an angle α (slightly different for each section) with respect to the relative water flow incident to the movement of the ship and the turning of the propeller.

(b) At a certain value of the angle α, negative with common sections, no thrust will be developed, although, due to the blade friction, torque will be required to turn the propeller.

(c) At still greater negative values the thrust will be reversed (from which follows the principles of reversible propellers).

(d) Slip is necessary (like the angle of attack of an airplane wing) for propeller (thrust producing) action, and not a "preventable loss," an idea doubtless suggested by the supposed similarity of the propeller action in water to the machine screw action in solid materials.

(e) The slip angle is normally small.

As an example to test his understanding of the method of analysis given above it is suggested that the reader work the following problem: In what direction will a propeller turn if it is drawn through the water after being disconnected and allowed to turn freely, as in the case of a 4-shaft electric drive ship dragging two propellers while being propelled by the other two? Then prove the result by using two electric fans in tandem.

The above explanation has been made, and Figs. 2 and 3 have been drawn, assuming that the propeller was working in undisturbed water and moving through the water parallel to the axis of the shaft.

The wake of the ship. When a propeller works behind a ship, however, these assumptions clearly do not hold. For a ship in its forward motion affects the water so as to give rise to the wake, usually considered as a current in the direction of ship motion, which affects the relative flow of water to the propeller.

Using the data of Fig. 3(d), Fig. 4 has been drawn to a larger scale to show the effect of wake. Wake is usually expressed as a fraction of the speed of the ship and in this case has been assumed to be $0.1v$. In Fig. 4 this value has been laid off as an instantaneous velocity and compounded with the previously obtained value of relative water flow, vr, to obtain the new value, ve, of the relative flow of water to the propeller. Under these conditions the thrust and torque reactions correspond with the reduced rela-

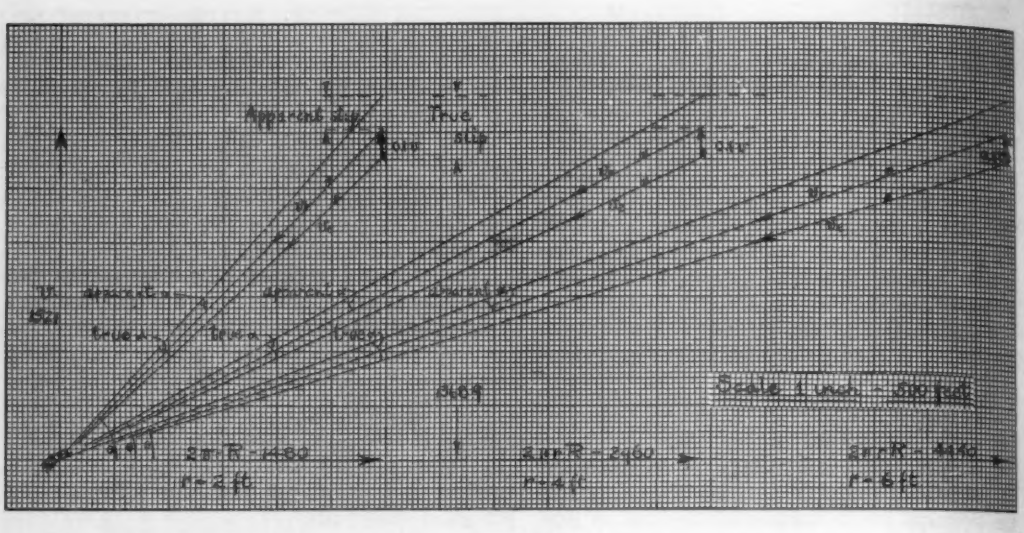


FIG. 4
Velocity Diagrams for v = 15 knots, P = 14.25 ft., R = 117.8 r.p.m., W = 0.1.

tive velocity *Ve*. But it should be noted that the thrust actually works through *v* feet per minute, the distance the ship moves.

The suction of the propeller. Another factor which must be accounted for in the problem is the suction caused by the propeller. This reacts on the ship so as to interfere with the flow of water past the hull, and to increase the speed of flow and consequently the resistance, with the result that for a given speed the thrust of the propeller must be greater than the towrope pull which would be found necessary by towing the ship at the given speed through undisturbed water.

Conclusion. It will doubtless be realized that the foregoing explanation is made up largely of mathematical concepts representing average and resultant conditions and has made the problem appear simpler than it really is. The interaction of wake and propeller suction is very complicated, making the relative and actual flow of the water to the propeller turbulent, that is, in different directions at different points of the propeller disc; with the result that the slip angle, and relative flow velocity, *ve*, vary considerably from this cause. It was seen above that the slip angle α varies due to the construction of the propeller, considering only the driving face of the sections of the blade. Further, the actual slip at which a propeller

TABLE I
U.S.S. *Tennessee* Propellers
Diameter 13'–6" *Pitch 14'–3"*
Projected area 52.1 sq. ft. $\frac{Pa}{Da}=0.364$

Angles of Fig. 4

r (feet)	2	4	6
$\tan\theta=\frac{PR}{2\pi rR}$	1.134	.567	0.378
θ	48°–36′	29°–33′	20°–12′
$\tan(\theta-\alpha)=\frac{v-Wv}{2\pi rR}$	0.925	0.4625	0.3083
$\theta-\alpha$	42° –46′	24 –49′	17°–08′
(true slip angle) α	5°–50′	4°–44′	3°–04′

Calculations for Figs. 3 and 4

v (Knots)	v (ft/min)	Corresponding R (r.p.m.)	P.R.	$2\pi rR$		
				$r=2$	$r=4$	$r=6$
10	1013	78	1111	980	1960	2940
15	1521	117.8	1667	1480	2960	4440
19	1926	152.3	2170	1914	3828	5742

With wake applied to Fig. 4

	vr	ve	$\frac{ve}{vr}$			
$r=2$	2122	2015	0.95			
$r=4$	3328	3260	0.98			
$r=6$	4694	4648	0.99			

will work is dependent also on the shape of the back of each section, with the result that the effective (true) slip angle at any section is practically indeterminate. To emphasize how the slip angle varies in amount, the theoretical values of true slip angle are calculated above for the conditions of Fig. 4. The calculations incident to the construction of Figs. 3 and 4 are also given.

Although the foregoing may not be a simple explanation, it is hoped that enough thought on the subject may have been stimulated in a reader to enable him to satisfy himself and possibly to give a simple explanation to the inquiring child or landlubber.

SARATOGA AND SQUADRONS

By Lieutenant Commander Ralph Wood, U. S. Navy

THE airplane carrier introduces a markedly different type of ship from those to which we have become accustomed. As one might imagine, the employment of these carriers has certain novel features not encountered in other gun-carrying ships of the fleet. These features embrace not only the methods of operation but also the internal organization.

Experimentation with the *Saratoga* and *Lexington* was of short duration because of the valuable experience gained in the operations of the *Langley*. Almost at once we find the two big carriers taking their place in the fleet and operating at full strength. In the two years with the fleet a stabilization has been achieved in the internal type of organization. Considering the novelty and departure from previous types and in view of the silence of Navy regulations on the subject, there is surprisingly little difference in the organizations.

The carriers are considerably larger than our biggest battleships not only on a tonnage basis but more so in consideration of spaces. A newly arrived officer is impressed with the immense distances involved and the apparent complexity due to the presence of the hangar and aircraft shops. These, together with the compartmentation, make formidable journeys of what, on other ships, are quite simple movements. The hangar with the space of about 600,000 cubic feet is placed centrally so that many of the living spaces are disposed around it in such a fashion that they form passageways. As one might expect this is inconvenient and the source of much additional labor in cleaning and in fast movement.

In addition to those features found on our latest battleships we find introduced the following provisions arising from aircraft requirements. The whole topside, except for the island structure of turrets, navigating bridges and smokestacks, is decked flush for the landing and take-off of planes. No openings are of course permissible in this deck other than one or two small hatches and the elevators. These in their secured position offer no obstructions. The hangar has been mentioned. Adjacent to this hangar are the necessary shops for the assembling, overhaul, and repair of planes and engines. These shops are fitted to undertake all the work usually done at shore repair bases. Amount of output is limited only by necessary considerations of space available. Here one finds erecting, wing and fuselage repair, fabric doping, and painting shops for the plane. In addition there are aviation engine machine shops, foundries, metal working, instrument repair, engine assembling shops and test stands. In convenient proximity to the hangar and shops are located the storerooms containing all necessary parts and spares.

Magazines for strictly aviation material are provided in addition to those reserved to the gun batteries. In these are stowed aviation bombs of varying sizes, machine gun ammunition, pyrotechnics, and torpedoes. Armories, optical and instrument repair facilities, and parachute repair rooms are also installed.

More than 100,000 gallons of high test aviation gasoline are carried in a series of large tanks on both sides of the ship. An extensive and seemingly intricate system of pumps and piping provides for the delivery of this gasoline to all parts of the ship where planes or boats may be fueled. In similar fashion there exists a lubricating oil system of tanks, pumps, and piping.

All these items together with certain ready, plotting and aërological rooms comprise what might be called the fixed material and equipment devoted to strictly aviation purposes. Because none of the facilities came naturally under the province of any established department, all except paymasters' storerooms were grouped into an air department. The squadrons themselves, planes, power plants, and personnel being also assigned to the air department, we readily

perceive that this new department differs radically from any others in the ship in that a natural cleavage exists between the fixed material and the movable equipment, the mobile squadrons.

Having decided on the formation of this air department and in absence of any regulations or past experience in such a department, it was natural to seek analogies. The engineers' department came nearer than any other existing subdivision in the concept of a complete department. Accordingly the air department was organized, where possible, following the broad outlines of the engineering organization. All the spaces and equipment devoted to aviation were assigned for maintenance and operation to the air department.

Once the carrier found itself, and all hands became conversant with strictly carrier needs and operation many items were turned back to the various other departments in the interests of economy in time and personnel. Thus it is that at present the first lieutenant billets the air department, the engineers maintain various motors and hydraulic equipment, and the radio officer looks out for the storage batteries and radio repair facilities of the planes.

The fixed equipment is cared for by four divisions of the department. The eighteenth division is charged with the whole of the flight deck, the catapult, arresting gear, crane, booms, nets, and such. This division has mainly to do with the receipt and dispatching of all aircraft. The nineteenth division looks out for all matters of aviation ordnance. It cares for the magazines, armories, and torpedo stowages together with equipment concerned including that used in the transfer of munitions to the planes. The twentieth division has charge of the hangar, all shops, the gasoline and lubricating systems, together with technical assistance in connection with stowage of parts and spares. This division also provides the inspection crews for aircraft. The twenty-fifth (now to be known as the twenty-first) division embraces office management, communications, navigation and plotting, intelligence, aërology, and the ship's utility planes.

Besides the head of the department and an assistant, officers and junior officers are assigned the service divisions just mentioned. The department requires for the service divisions nine commissioned officers and six or seven warrant officers. It is desirable that the commissioned officers be aviators but one or two experienced observers may be substituted in the plotting rooms and for ordnance duties. Ordinarily, aviation officers are responsible to the other departments through the air officer. There is an air officer on duty at all times who is charged with the transaction of the department's daily business. Responsible to the senior air officer, it is his duty to receive and dispatch planes, operate the gasoline and oil systems, and care for communications having to do with aviation. As might be expected the department is messed and berthed together within its own spaces.

At present four squadrons are assigned to the carrier. These squadrons are normally of eighteen-plane strength, commanded by lieutenant commanders and complemented by officers, in a varying degree dependent upon the type of the squadron. The light squadrons usually have one officer per plane while the heavy squadrons may not have a total of more than six officers. The men average about seventy to the squadron.

Extreme mobility is a most important attribute of any aircraft squadron. To this end, every effort is made to maintain the integrity of a squadron intact. Each squadron when embarked continues its own internal organization. Its personnel is berthed, messed, and worked together. All matters are handled through the squadron commander. Special details such as bakers, cooks, and specialist mechanics are assigned to work with the corresponding ship's force, but leave the ship with their own squadron. All men's records, papers, and such are retained by the squadrons but the administration is controlled by the executive officer. Pay rolls are intact and handled by the disbursing officer in such a fashion that they can be closed out and transferred within a minimum time.

While as a matter of principle the squadron is administered by the squadron commander, still for purposes of convenience, much of the routine is handled directly by those squadron officers charged with the various duties. The executive of the squadron for instance would prepare watch bills in direct consultation with the assistant for service, the personnel officer takes on the usual duties assigned a division officer, the

engineer officer consults directly with the shops officer concerning routine repairs and replacements. Finally the squadron duty officer moves and works on planes under the air duty officer.

With all squadrons embarked, the squadron commanders are assigned head of department duty, the executives form the air duty officer's list. Other lieutenants stand the security watch which is charged with the care of all planes kept on the flight deck. All junior lieutenants are assigned deck or supervisory deck watches, while ensigns are placed on watch as junior watch and boat officers. The warrant and chief warrant officers stand an integrity watch over the hangar and shop spaces. The men of both squadrons and service divisions are assigned watches within the air department.

The aircraft squadrons commanded by a rear admiral constitute a major unit of the fleet. It consists of carriers, tenders, and squadrons. Within this force either of two systems of control may be employed. In the first the carrier's squadrons are considered as belonging only to that ship and are dispatched, controlled, and recalled by the carrier captain working under general orders from the force commander. In the second system all squadrons of the force are controlled directly by the force commander with the carriers forming one of the task groups for service facilities mainly.

There is probably no one point concerning administration that has provoked more discussion than that arising over the relative merits of these two systems. Experienced unit commanders, ships' captains, squadron commanders, and air officers are not only to be found on both sides of the question but all around it. And these opinions are firmly and often violently put forth. It is not the writer's intention to argue on either side but to set before the reader the system in use. It is interesting to note, however, that both before and after the advent of the carrier the control has invariably rested in the commander of the aircraft squadrons. It may be that with a force of many carriers this control will not be sufficiently secure, but apparently under present conditions it has proved to be the most compact and efficient.

It is clear that the system selected will influence entirely the organization and administration of the air department of the carrier. On the *Saratoga*, the senior squadron commander becomes the assistant to the air officer for operations including training. All matters to do with these items as found necessary are taken up directly between the captain and the senior squadron commander, with the air officer sitting in in an advisory capacity to the captain. For the air work proper, the squadrons are solely responsible; in the twilight zones and for the service divisions the air officer is responsible.

The present set-up and system employed are not thoroughly satisfactory but, with reasonable give and take, work well enough. It is expected that shortly a slight modification will be made in the duties assigned so that the use of the present system of control will be facilitated.

To the uninitiated, the apparently prolonged absence of squadrons from the carrier requires explanation. Briefly expressed this absence is necessitated by economy. Economy of both time and money. Considering the carrier only for a moment we find that exclusive of dockyard periods ten to twelve weeks in the year must be devoted to engine-overhaul periods. Then there are two months during which the ship is in the yard for refit and repairs. Here are five months during which the squadrons cannot possibly operate out of the carrier. During the time devoted to the ship's gunnery training and the firing of the prescribed practices it is impracticable to operate squadrons from the ship. The mutual interference in the two forms of training is too great. It is usual to allow two months for gunnery, so our total unavailable time is brought to seven months. Then comes the fleet concentration, which, this last year, consumed four months. During this period there is time only for finished work with all units well trained and drilled, operating in coördination. Thus in round figures we find but one month a year available for squadrons to train out of their own ship. With four squadrons concerned it is apparent that most of the squadrons' training must take place elsewhere. That "elsewhere" for the battle fleet is the Fleet Air Base at San Diego. Here the squadrons are based during a great part of the year. The ship and squadron organization is retained intact during this interval. All available facilities are furnished so that the intra- and inter-squadron training may progress steadily throughout the year.

During the early summer months recent additions to the squadrons are drilled in elementary tactics, specialized flying, gunnery, and carrier landings. The tactics progressively involve larger units until the whole force can act as a unit. Following the elementary gunnery, the regular practices are fired in order until all have been completed prior to the winter cruise. During this time all available opportunities are used to send the squadrons to their own or sister-carriers in order to carry out shipboard operations involving tactics and firings. Often the monthly battle fleet exercises afford this opportunity. Thus it is that when the time arrives for the fleet concentration and cruise the squadrons are embarked well trained in their own specialties and capable of deriving benefit from the major employments with the fleet as a whole.

Embarkations of the squadrons for short periods are accomplished in a matter of a few hours. Where the cruise is to be of some duration one day is usually occupied with getting desirable squadron gear on board. The receipt of the squadrons (planes) themselves occupies, of course, but an hour or so. The disembarkation is as rapid. Arriving off the base at early morning the planes and gear are sent ashore and the carrier is on her way to anchorage by late afternoon.

It would take too long to go into the varieties of operations of the squadrons aboard but as an example one type may be described.

Upon the landing of each plane it is sent below or forward on the flight deck and parked. This parking is done with a minimum loss of space and the planes are jammed as closely as possible. The pilots report to the "ready room" where complete reports are made out and further orders or comments are issued them. After all planes are landed they are refueled and minor repairs made as required. They are then moved about preparatory to the next operation. This is known as "spotting" the planes. The "spot" allows the simultaneous turning up of all engines.

Assuming the squadrons are to take off, the engines are warmed up sufficiently in advance so that corrective measures may be taken in balky cases. Then a half hour before the event, "flight quarters" is sounded. At this call all pilots report to the "ready room" which is in the island structure on the flight deck level. Here they obtain final instructions, navigational data, and such. The squadron and wing commanders report to the air plotting room where they go over the charts and check up on recent developments at the same time receiving any last minute instructions. In the meantime the planes have been attended by the plane captains and the handling crews. When all is in readiness the order is given "man the planes" and when the pilots have clambered in, adjusted themselves and their gear, the order "stand clear of the propellers" is followed by "start the engines." The ship if not already heading into the wind is swung onto such a course and speed modified to cause the proper wind over the deck. As one knows, it is the speed of wind past the wings which gives lifting power. On shore the plane runs along the ground until such speed is attained as to lift the plane. On board, the limited run allowed the plane is compensated by the ship speeding up so that the combined additive speed of the ship plus the plane speed on deck is enough to lift the plane before the bow is reached. A cross wind offers difficulties and if of any intensity may be quite dangerous. It is therefore necessary that the ship be steaming directly into the wind when planes take off or land. It is usual to have a minimum wind of twenty knots but a variation may be had depending on how close to the bow the planes are spotted. With planes well forward or heavily laden higher speeds are necessary.

With everything in readiness, ship at speed, steadied on her course, and engines or planes turning up, the order "take off" is passed. At this word one by one each plane in order is signaled by the "take-off officer." He sees to it that the planes follow each other promptly but not so close as to form an unnecessary hazard. As the planes take off they proceed to the designated zones where each squadron forms its rendezvous. Once in formation the squadron proceeds on its mission. This take off can be made with a celerity that compares favorably with a similar operation at a crowded airdrome ashore.

There is probably no other type of strictly ship operation which requires such close timing and careful preparation as is involved in carrier aircraft operation. Certainly the

admiral or captain who has sudden use for a squadron of heavy bombers only to discover they are stowed well aft in the hangar with the flight deck loaded with planes will have plenty to say regarding the planning that got him into that difficulty. With a ship carrying its maximum of planes very little elasticity of disposition is allowable and very careful thought must be expended to prevent a frozen condition. Timing of operations becomes all important when squadrons are to be continuously and successively dispatched, received, reserviced, and dispatched again. To note two extremes in timing consider the case where one commander can get a force of bombers over the enemy carrier while the latter's planes are still on deck; then that, wherein one commander can entice the enemy air force into the air, keep it there while refusing action and then as the enemy fuel becomes exhausted pounce on his carrier loaded with useless planes.

A clever little device assists in planning for plane operations. A series of boards have been built to scale showing the exact plan of the deck spaces. Also there are at hand numbers of cardboards cut to the same plan and scale for each type of plane involved. When a certain series of operations is planned the whole is worked out in miniature with this "ouija board" as it is called.

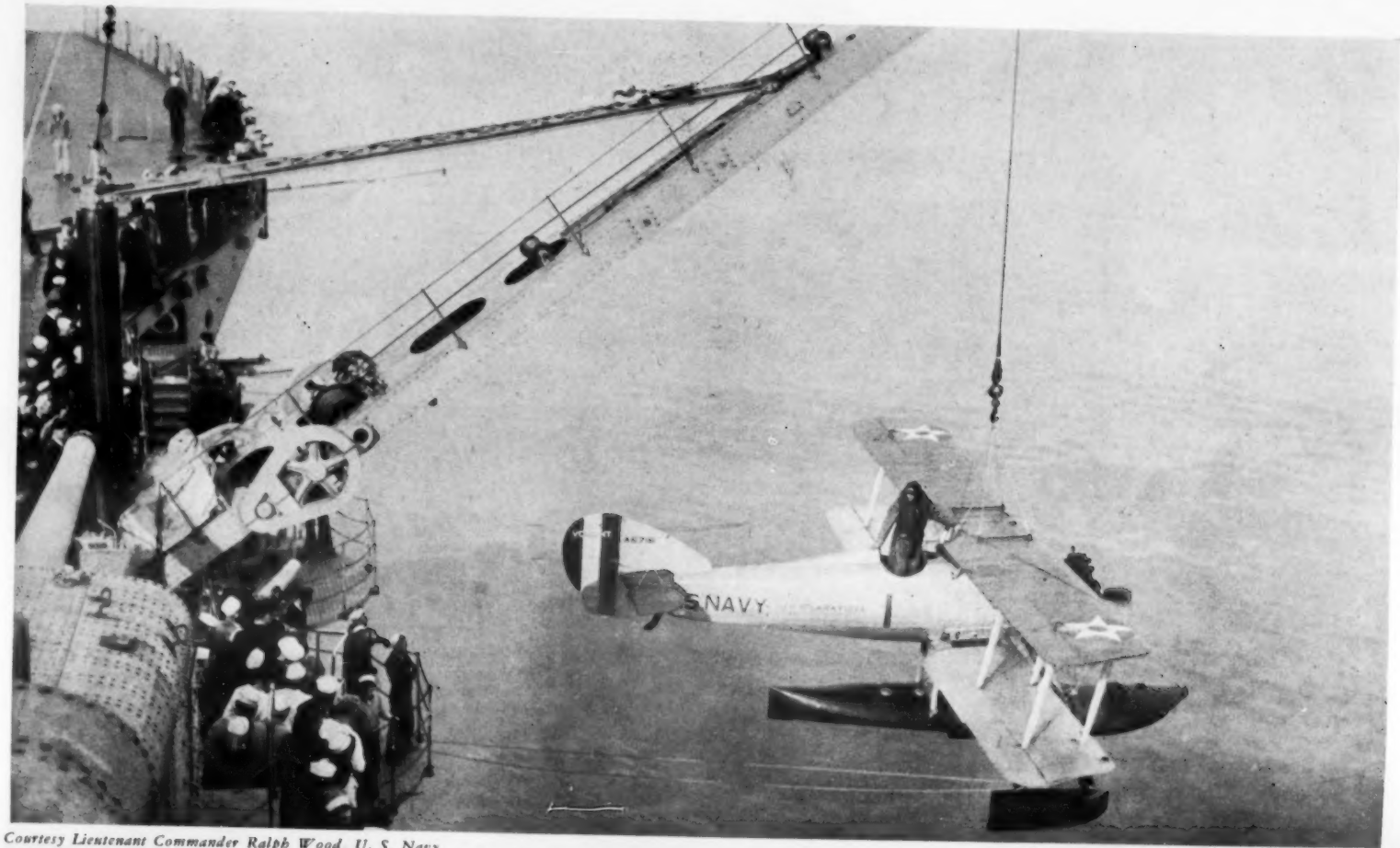
Far from the promises made by a certain type of aëronautical proponent, aviation has proved quite costly. To the expense of planes that must be entirely rebuilt each eighteen months and which are obsolescent in three years is added the tremendous cost of the large carriers. The ordinary costs of such a large ship with its crew of some two thousand men are increased beyond any other type of ship when one takes into account the excessive fuel bill arising from the use of frequent high speeds when operating the squadrons. If the wind is light or from an unfavorable direction the carrier after launching or receiving planes may find herself long distances from the main body. It then is necessary to use continued high speed to regain the proper station.

This cost practically prohibits the continuous presence and training of all squadrons from their own carrier. When a squadron is engaged in gunnery relatively short flights are sufficient to approach the target and empty the magazines. A landing must be made in order to reload. It is not unusual for a pilot to make six runs in a half day's work. For a squadron this would mean 108 landings alone. Given four squadrons one can see that a carrier could not possibly afford as many runs per pilot as is requisite for proper training. Inasmuch as a deck landing requires a more expert attention and is somewhat more difficult to make than one at a large field, a certain proportion of casualties to landing gear must be accepted. It is the summation of these various costs and limitations which makes it necessary that much of the squadrons' preliminary training be accomplished at an adequately prepared shore base.

Much has been learned from the operations of our two big carriers with the fleet. For one thing, it has been found that relatively greater total effort can be accomplished with smaller carriers that have slightly less speed. This will allow more carriers to be built within the total tonnage limitation and will tend to a desirable flexibility in the disposition of our aircraft squadrons.

FLYING ON BOARD AT ANCHOR

Courtesy Lieutenant Commander Ralph Wood, U. S. Navy



Courtesy Lieutenant Commander Ralph Wood, U. S. Navy

UTILITY PLANE GOING OVERBOARD FOR FLIGHT

Air Department Photograph, U.S.S. "Saratoga"

Courtesy Lieutenant Commander Ralph Wood, U. S. Navy

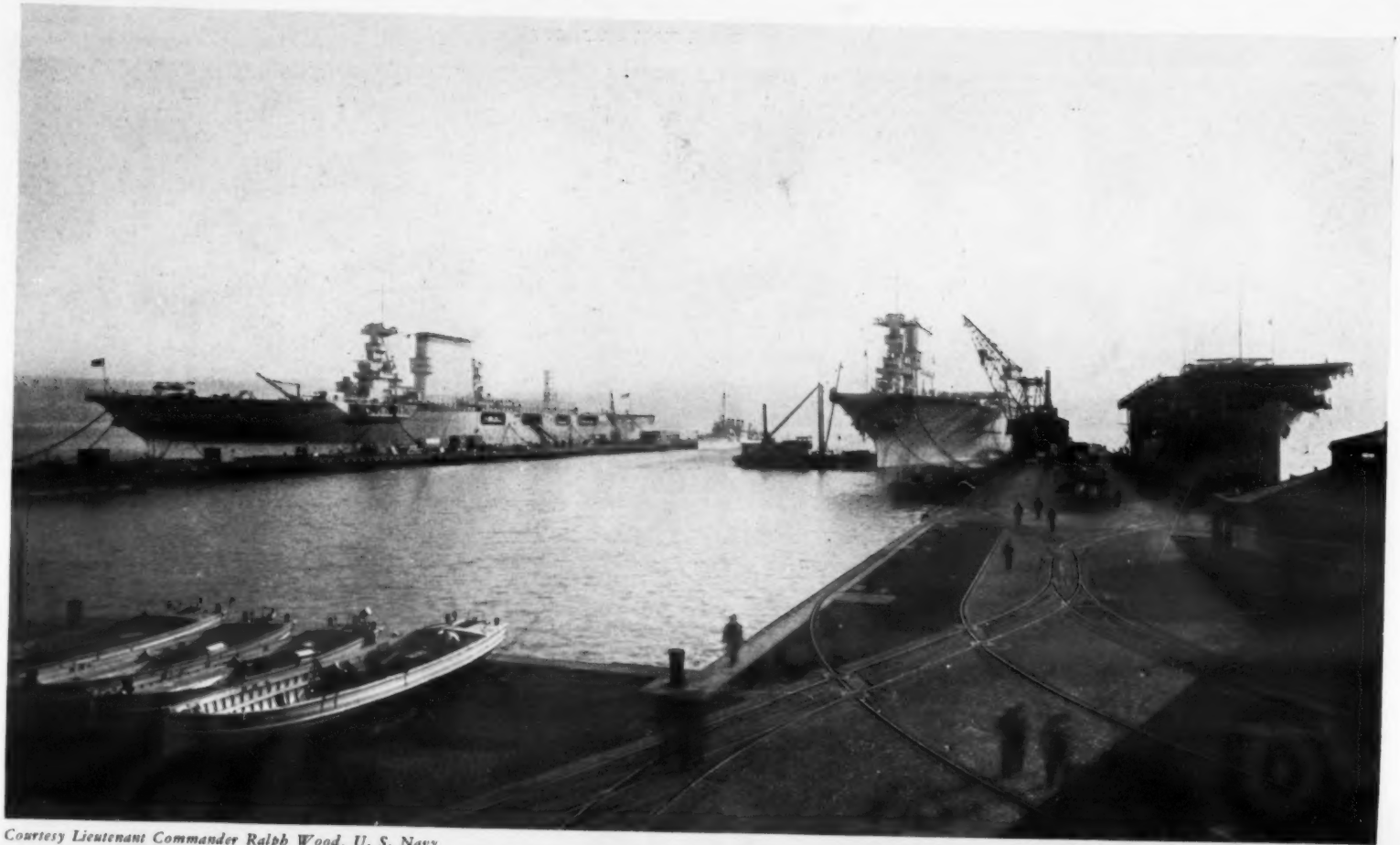
UTILITY PLANE GOING OVERBOARD FOR FLIGHT

Air Department Photograph, U.S.S. "Saratoga"

Courtesy Lieutenant Commander Ralph Wood, U. S. Navy

ABOUT TO TAKE UPPER AIR SOUNDING

Air Department Photograph, U.S.S. "Saratoga"



Courtesy Lieutenant Commander Ralph Wood, U. S. Navy

ALL THREE CARRIERS IN YARD AT ONE TIME

Air Department Photograph, U.S.S. "Saratoga"

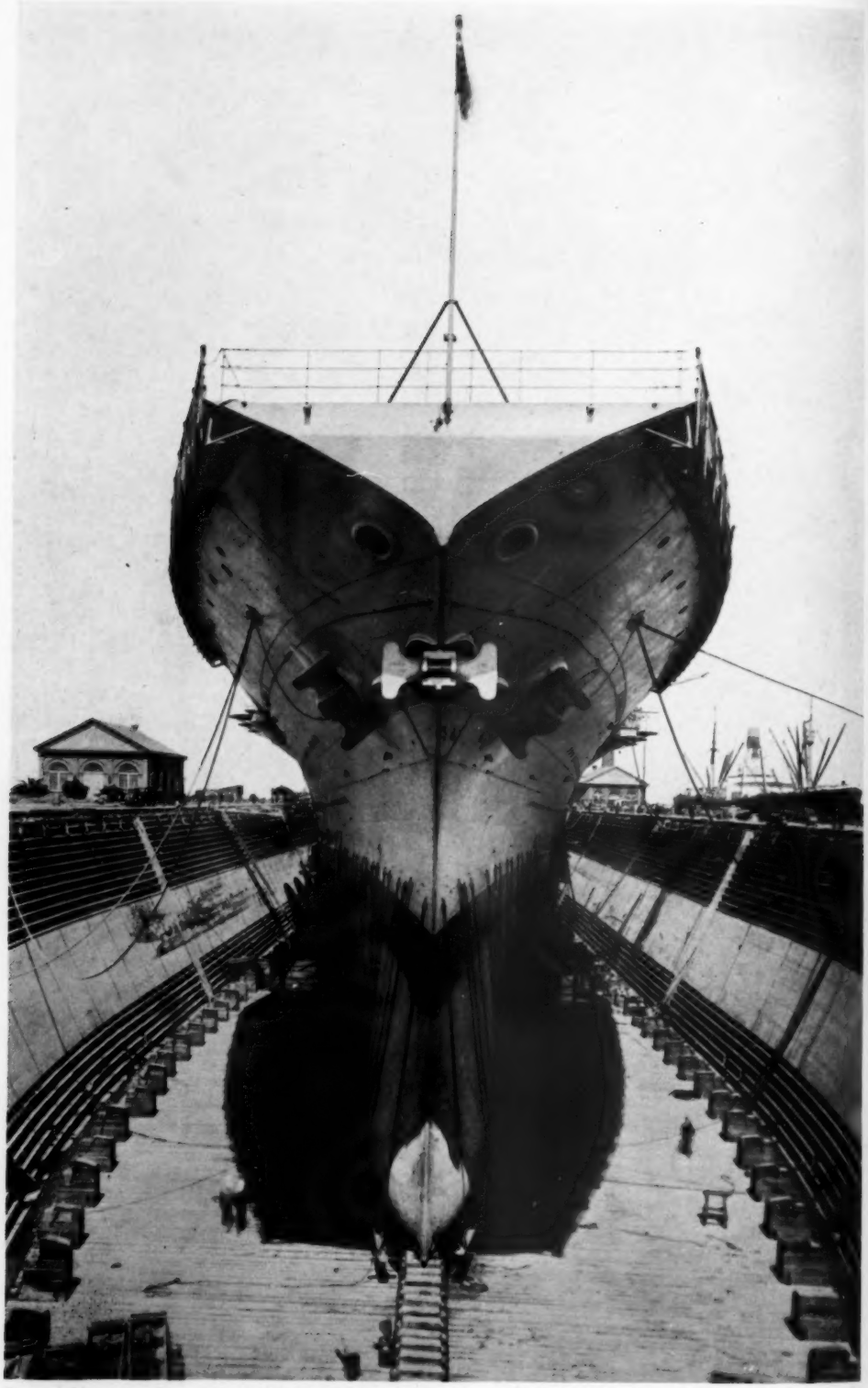
ALL THREE CARRIERS IN YARD AT ONE TIME

Air Department Photograph, U.S.S. "Saratoga"

Courtesy Lieutenant Commander Ralph Wood, U. S. Navy

AVIATORS' READY ROOM, U.S.S. *SARATOGA*

Air Department Photograph, U.S.S. "Saratoga"



Courtesy Lieutenant Commander Ralph Wood, U. S. Navy *Air Department Photograph, U.S.S. "Saratoga"*

SARATOGA IN DRY DOCK

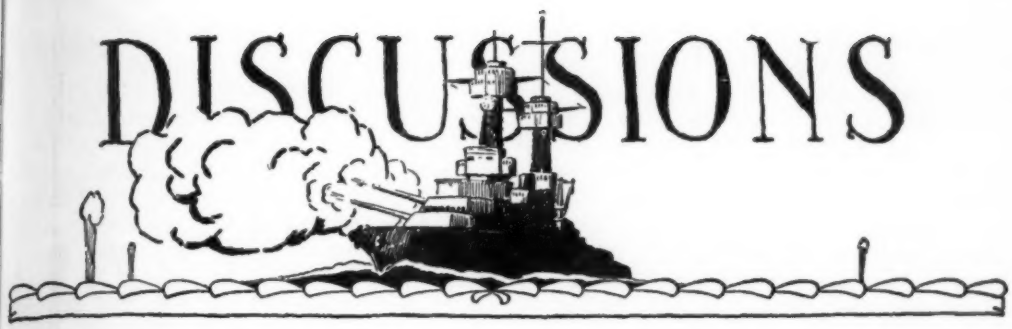
Courtesy Lieutenant Commander Ralph Wood, U. S. Navy *Air Department Photograph, U.S.S. "Saratoga"*

LINDBERGH IN THE NETS DURING FLIGHT OPERATIONS

Courtesy Lieutenant Commander Ralph Wood, U. S. Navy *Air Department Photograph, U.S.S. "Saratoga"*

U.S.S. *SARATOGA* FILLING ONE LOCK

DISCUSSIONS



Possibilities of the Diesel-Engined 10,000-Ton Cruiser

(See page 505, June, 1930, PROCEEDINGS, and page 846, September, 1930, PROCEEDINGS)

EDWARD B. POLLISTER, President, Busch-Sulzer Bros.—Diesel Engine Co.—Captain Dinger's statement that "No actual builder of Diesel engines in this country is now prepared to build the engines that the author presents for our consideration" must not be allowed to go unchallenged.

If given reasonable encouragement and the necessary coöperation, I believe that more than one American Diesel builder would be willing, and able, to undertake the designing and building of Diesel engines that would successfully meet the requirements of the 10,000-ton cruiser. Certainly, before such a statement should be made, a few experienced and successful builders of Diesel engines should, at least, be given the opportunity to study the problem, which, so far as I know, has not been permitted to them, and themselves to say what they can and what they cannot do, in the premises. Research and development would, of course, be necessary; and Germany and other European Diesel builders have progressed in Diesel engineering largely through the support of their governmental orders for Navy Diesels for battleships as well as submarines.

Captain Procter has shown commendable interest and a high degree of Diesel engine insight in deducing from the meager information available the probable radius of operations of the *Ersatz Preussen* as 20,000 miles, instead of the 10,000-mile radius officially admitted. As the advantage of such a radically new type of cruiser lies largely in being ahead of other navies in its use, obviously, such an advantage as a 20,000-mile radius would not be broadcasted.

During the past war, fuel was found to be the great limitation and handicap of the German commerce raider. This limitation, Germany has promptly removed by substituting Diesels for steam in the new 50,000-hp. *Ersatz Preussen* type of cruiser. Utilization of waste heat from Diesel propelling engines should provide, at cruising speeds which determine the radius, for all auxiliary power, heating, lighting, and cooking on board; and this should result in a thermal efficiency of substantially above 50 per cent —over twice that of steam. For any bunker capacity, it cannot be gainsaid, that the Diesel cruiser would therefore have a radius of operations over twice that of the steam cruiser.

Captain Procter's estimate of 0.40 lbs. of fuel per s.hp. hr. for all purposes does not seem unreasonably optimistic. For any normal voyage of several months' duration, the average speed of the ship would probably be around 15 knots, requiring some 10,000 hp. Two of the engines Captain Procter suggests, would provide this power at 160 revolutions, with a piston speed of 800 ft. per min., a mean effective pressure of around 40 lbs. per sq. in. and a fuel consumption of under 0.40 lbs.—more favorable operating conditions than prevail on merchant ships.

In modern motorships, exhaust silencers are replaced by exhaust gas boilers, without much if any increase in weight, and Diesel waste heat is used for raising steam for ship's auxiliary power, for heating, lighting, and cooking. Such waste-heat boilers on the H.M.S. *Britannic* and H.M.S. *Winchester Castle* produce 10,000 lbs. of steam per hour. The motor cargo ship *Sheaf Holme*, of only 1,500 brake hp., operates all steam driven auxiliaries with steam supplied by a Diesel waste heat boiler, which evaporates

0.84 lbs. of water per b.hp. at from 60° F. to steam at 100 lbs. per sq. in. The equivalent saving of about 1.5 tons of oil per day results in a reported fuel consumption for the ship of 0.365 lbs. per s.hp.-hr. for all purposes. A heat balance would possibly establish the *Ersatz Preussen* as the world's most economical ship, with an overall thermal efficiency of above 60, compared with around 20 for our steam cruisers.

Such a Diesel naval vessel, averaging 15 knots, with 3,500-tons bunkering capacity could remain away from her fuel base 3.4 months and cover 36,750 miles. Henry Cabot Lodge, in his article, "The Power of the U. S. Fleet," (*Fortune*, June, Proceedings, October) shows that, with only seven United States outlying naval bases, compared with British twenty-six, in order to keep two cruisers each on station at Gibraltar, Cape of Good Hope, Singapore, and Panama, the United States would require twenty cruisers, to provide for refueling and repairs, as against fourteen British. A Diesel ship on such service would have the effectiveness of at least two steamships and in a measure offset the lack of naval parity, pointed out by Mr. Lodge.

Concerning Captain Dinger's figure of 0.5 lbs. of oil per Diesel horsepower for all purposes at near full power, it must be borne in mind that the latest Diesels in use in our Navy, other than some of small capacity, are fundamentally of designs that were up to date a decade ago. The more recent revolutionary progress in marine Diesel engineering abroad unfortunately has not penetrated American engineering circles. Due to the lack of motorship building in America, marine engineers and naval architects have not had occasion to study the thermal efficiencies of Diesel ships, or to explore the possibilities of maximum utilization of Diesel waste heat.

Regarding weights, as Captain Procter has pointed out, increased piston speeds and mean pressures, combined with the use of special materials, the result of recent Diesel engineering and research, have made possible the reduction of Diesel engine weights all the way down to the 2.5 lbs. per horsepower of the airplane engine. The Navy requirements of around 25 lbs. per horsepower are, at least, not nearly so difficult.

The service of the cruiser would be far less severe than for commercial motorships on long runs at constant speeds with full output of the engines constantly required. The occasional use of the full 80,000 hp. would demand that the engines be designed for this maximum condition of speed and output; but normal cruising operation at reduced speed and power would be so favorable as to increase the life expectancy of the machinery to well beyond the life of the ship, considering obsolescence.

As a constructive suggestion, why not select one of the three battleships which are soon to be overhauled and modernized and install Diesel propulsion. The power is only 30,000 hp. on quadruple screws and the problem of developing 7,500 hp. Diesel engines, of suitable weight and design, certainly would not appear to be insurmountable. This would be true modernization of an obsolete battleship, and would provide a source of actual information on modern Diesel practice as a guide in designing 80,000 hp. cruisers for the future.

Merchant Marine Reserve vs. Fleet Reserve

(See page 803, September, 1930, Proceedings)

Lieutenant George W. Akers, U. S. Naval Reserve.—Lieutenant Commander Katterfield's advocacy of the practical abolition of the present Fleet Naval Reserve overlooks many details of the existing situation.

In the first place, the present Naval Reserve and its three branches are definitely established by law and only by repeal of the law and enactment of new statutes could the Merchant Marine Reserve be changed to the Fleet Reserve.

It also seems that he has overlooked the missions of the two branches of the reserve which are stated in the *Bureau of Navigation Manual* as follows:

"The mission of the Fleet Naval Reserve is to create and mobilize trained organizations for service on board vessels of the United States Fleet and Naval Transportation Service in the theater of operations.

"The mission of the Merchant Marine Naval Reserve is to train officers and men serving on seagoing vessels of United States registry for service on their own vessels when commissioned by the Navy in the event of war."

The law and the missions above stated comprehend, for the Fleet Reserve, the furnishing of not only officers but also enlisted

men, as units, to man certain definite ships; mostly destroyers. Note that the mission says, "Trained Organizations." Those trained organizations are what 148 fleet divisions throughout the country are aiming at in their fifty-drill periods and two weeks active training duty each year.

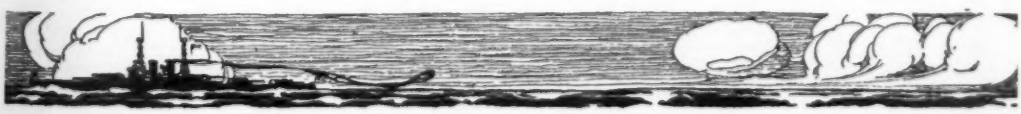
Most naval and naval reserve officers today realize very keenly that, to carry out the naval policy which was so clearly and ably laid down during Secretary Denby's administration, the Navy must sell and keep selling the American people on its aims and activities. The fleet divisions have rendered and still are rendering very good service along these lines. Last year in one of the country's largest cities, several hundred miles from either coast, the Naval Reserve seagoing and aviation divisions and the Marine Corps Reserve company took part as a unit in three civic parades calling forth much favorable comment in the press and otherwise. The state and city appropriated land and $350,000 by means of which a beautiful naval armory was built in a public park and the public is admitted to most of the weekly drills. This particular state has also furnished the land and funds for a seaplane harbor, a hangar, administration building, and machine shop for the aviation squadron of the naval reserve. Last year a committee of prominent citizens and naval reserve officers obtained the donation of seven large illuminated Navy Day signboards in prominent parts of the city, arranged a Navy Day church service attended by several hundred men in uniform and written up by all the local papers, arranged for all naval and naval reserve officers to call on the mayor at noon Navy Day to pay their respects, at which time cameramen recorded the event which was shown in all the local and many out-state movie houses.

These things are typical of what all naval reserve divisions are doing entirely aside from their training; all of which are indirectly valuable to the Navy.

I do not believe Lieutenant Commander Katterfield's statement that state militia officers, during the World War, were often unable to perform their duty adequately is borne out by the facts. Secretary Daniels, Admiral Sims, Admiral Gleaves, and many others in their histories have testified to the extremely valuable and entirely satisfactory service rendered by most reserve officers and men.

The author's statement, that the practical sea training of fifteen days yearly now given to the Fleet Reserve falls far short of the requirements, is no doubt true if he means ideal requirements. Most reservists would like to take longer or oftener training periods but lack of appropriations and inability to get away from civilian occupations prevent. If his plan of changing the Merchant Marine Naval Reserve to the Fleet Naval Reserve were put into effect, how many officers and men of the Merchant Marine would leave their ships and runs for fifteen days' training yearly, to say nothing of the three months that he recommends?

An actual reserve mobilization plan has been worked out, is now in effect, and is being improved upon each year. It is the basis upon which appropriations are now asked for and obtained. It seems that, better than tearing down what is already built up to substitute a plan that may or may not be a success, the thing to strive for is the necessary funds from Congress to carry out the mission of the Merchant Marine Naval Reserve in addition to the continued functioning of the Fleet Reserve.



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UNITED STATES

"Treaty Navy" Delay beyond 1936 Likely

New York *Times,* December 10.—Admiral William V. Pratt, chief of naval operations, voiced the opinion before the House Naval Committee today that the Navy would not be built up to the maximum strength authorized by the London Naval Treaty by 1936.

The Navy Department, he said, hoped, however, that Congress would "authorize" the construction of all ships needed to bring the fleet up to the treaty tonnage limits before the treaty expires in 1936. This would mean authorizations totaling about $1,000,000,000.

Because of the costs of construction and a desire to test the new experimental types of ships, the Navy planned to spread its building program over a number of years beyond the expiration date of the treaty, Admiral Pratt said, and hence would spread its requests for appropriations over the longer period.

Admiral Pratt advocated the immediate authorization of the cruisers, submarines, and aircraft carrier provided for in the $85,000,000 Britten bill introduced Monday.

The most important feature of the naval construction bill, he asserted, was the aircraft carrier of 13,800 tons to cost $27,650,000, and the second most important the construction of the 10,000-ton, 6-inch gun cruiser, equipped with an experimental flying deck, to cost $20,780,000. Upon the success or failure of the new-type cruiser, he said, might rest the future design of the capital ship.

Admiral Pratt said he believed the projected flying-deck cruiser would compensate, at least in part, for the "'sacrifice" of American 8-inch gun cruiser tonnage at London. His expressed opinion was that a vessel of this type, carrying from thirty to forty planes and equal in speed to the 8-inch gun 10,000-ton cruiser, would prove a match for the bigger gunned vessel, as it could launch its planes for a bomb attack before the 8-inch gun vessel came within range.

He said that the Navy proposed to utilize the total aircraft carrier tonnage allowed by the London treaty by 1936 and probably would ask for another carrier next year. The smaller carriers were favored over the *Saratoga* and *Lexington,* each of 33,000 tons displacement, because of greater maneuverability as well as for reasons of cost.

In answer to Chairman Britten, Admiral Pratt said the Navy would have built additional cruisers of the 7,500-ton 6-inch gun class even if the 10,000-ton 8-inch gun type had not been limited by the London treaty.

Although he would want only a limited number of 6-inch gun cruisers, the admiral said, they were more easily handled with the fleet than the larger type and were "invaluable" as scouting craft and for coöperation with destroyers.

Mr. Britten asked Admiral Pratt if the general board, which formerly wanted more 8-inch gun cruisers had changed its mind since the London conference.

"I think they are melting," the Admiral replied.

But with enough of the lighter vessels for close-in fleet work under protection of battleship guns, "I'd take all the 8-inch gun cruisers allowed and assign all excess tonnage to flying-deck cruisers," Admiral Pratt said.

An ultimate change in the design of the battleship rather than its abandonment by the major powers, was forecast by the admiral. This vessel, he thought, would combine great offensive gun power with ability to launch destructive bombs from the air at targets hundreds of miles distant. It would not be many years he thought, before the Navy would be asking Congress for an appropriation to build an experimental ship of the type he visualized.

Old Destroyers to Be Bombed

Army Ordnance, December.—Bombing practice with the hulks of two decommissioned destroyers, the *Sloat* and the *Marcus* will be the first research to determine the comparative effectiveness of 30- and 116-pound bombs since the Navy employed the battleship *Washington* as a target for aircraft attacks in 1921.

The *Sloat* and the *Marcus* are to be attacked off the Pacific coast this winter, while a third decommissioned destroyer, the *Stoddert* is to be equipped with remote-control apparatus and converted to a "perennial target." Experiments with the *Stoddert* probably will not be inaugurated until early 1931.

The success of the tests with the *Stoddert,* which will be subjected to machine-gun at-

tacks by airplane and will be a target for dummy shells and bombs, will determine a course of action for the future, since tentative plans already have been drawn up to convert five other decommissioned destroyers for similar bombing and firing practice.

Routine bombing and gunnery practice is performed by the aircraft squadrons each year, but only towed and stationary wooden targets and towed sleeve targets are used. An armored target has not been employed during the past ten years, and the routine practice determines only the percentage of hits.

Use of the two destroyer hulks as stationary targets will result in a financial saving for the department of the Navy. The ordinary wooden targets used cost $18,000 each, while the value of the two cruisers to be tested is estimated at $5,000 each, the amount which the Navy might expect to receive if these vessels were sold for scrapping.

The radio-controlled *Stoddert* will be a target for dummy bombs and "dud" shells from the secondary 5-inch battleship batteries, and will be towed back to port for patching after each test. Such an arrangement is expected to extend the life of the target vessel indefinitely and if the plans work out satisfactorily five other destroyers not yet selected will be used for this purpose.

Radio-controlled targets provide more realistic conditions for tests, although the vessels are not protected by antiaircraft guns or defensive airplanes. The greater speed at which such vessels can be maneuvered, however, is important in testing the accuracy of hits since the towed targets do not exceed a speed of eight knots.

GREAT BRITAIN

Smaller Submarines

The Naval and Military Record, November 12.—Orders have now been placed at Chatham for beginning work on two submarines of the 1929 program, which originally provided for six boats but has been reduced by one-half. These craft are to have a displacement of just over 600 tons, and are therefore smaller than any underwater boats laid down since some years before the great war. This is interesting, since it shows a reversion to the principle of the "efficient minimum" for flotilla work. The O- and P-classes of submarines, built since the war, average about 1,700 tons in displacement and are of the ocean-going type. Presumably these vessels are designed for independent service—as submarine cruisers, in fact. For fleet flotilla work the smaller the submarine—within reasonable limitations, of course—the better. The small craft is quicker in her evolutionary movements and less likely to be detected by the swell of her displacement wave. The Admiralty do not appear to have much enthusiasm for the submarine for fleet action work, and, of course, her very low speed when submerged is a serious handicap. There is a disposition to question whether the ever-increasing range of the torpedo is not having a neutralizing effect upon its value. The latest pattern has a run of 12,000 yards and takes nearly twenty minutes to cover this distance. A heavy high-velocity shell would take about twenty-five seconds in traversing the same distance.

As the torpedo is supposed to be an invisible weapon—in practice it seldom is—the invisible boat ought to be the ideal craft for torpedo warfare. But the submarine was not conspicuously successful against surface warships during the war. When she caught her prey "sitting," as in the case of the three *Hogues,* her work was easy enough. But in the few big actions of the war she was never where she was wanted. The Germans undoubtedly forced us into a competition of size. They built progressively bigger submarines to carry on their campaign against commerce, and we responded by turning out still bigger submarines with the idea of countering them. This rather unreasoning process appears to have been continued since the war—in spite of the confessed conclusion that the K-class and the *X1* are white elephants. The fact appears to be that there is no definite idea as to how the submarine will be employed. Apparently, however, it has been decided that she may still play a useful part in a fleet action, and that she will play this part the more successfully for being of small size.

Naval Mission to China

London *Times,* December 3.—In accordance with the Chinese-British naval agreement signed in June, 1929, in Nanking, the Admiralty announces that a British naval

mission will proceed to China to advise and assist the Ministry of the Navy of the Nationalist Government in the projected reorganization and modernization of the Chinese Navy.

Captain H. T. Baillie-Grohman, who was promoted in the June list this year, has been selected as the first head of the naval mission. He will assume the rank of commodore in the Chinese Navy, and will proceed to China early in 1931 to arrange preliminaries for the establishment of the mission with Vice-Admiral Chen, the Vice-Minister of the Navy in Nanking.

The remaining officers and ratings of the mission, the composition of which has not yet been definitely decided, will proceed to China when the necessary arrangements are complete.

Foreign Naval Commissions

The Naval and Military Record, December 3.—The Greek government has decided to continue the British naval mission to that country, and has so notified the Admiralty, requesting that further officers, to be selected by the Admiralty, be appointed to replace the members of the present mission when they become time-expired.

The Vickers' Pedersen Self-Loading Rifle

Engineering, November 21.—It is well known that the military rifle has not been developed to the same point of effectiveness as the machine gun, although the magazine rifle has been in use since 1890. The design of a weapon which has to be handled sometimes by partly trained men, has to be carried by the individual soldier, and has to stand rough usage, presents many difficult problems, some of which have hitherto only been solved at the expense of others, the success of the general solution not being complete enough to warrant the discarding of weapons which have, for want of it, to be retained in spite of their limitations. The Pedersen self-loading rifle, which is illustrated by Figs. 1 to 4, is claimed by Messrs. Vickers-Armstrongs, Limited, Broadway, London, S.W.1, to fill the requirements for effective small arms for both infantry and cavalry in a more thorough manner than hitherto.

The term "self-loading" is used for the rifle in the sense that once the magazine, which holds ten rounds, is placed in the breech, all the ammunition can be expended without any further effort than a pressure on the trigger for each shot, that is, there is no bolt to manipulate, and loading and ejection are automatic. At the same time it must be understood that to avoid waste of ammunition fully automatic working with a continuous trigger pressure has been deliberately avoided. From the general views given in Figs. 1 and 2, it will be seen that the new rifle is particularly free from any projections which might make it difficult to handle. It has a barrel 24 in. long, and a total length of 45 in. The weight is 8.8 lb. which compares favorably with the 9 lb. of the British service rifle. On the other hand the caliber is 0.276 in. (7 mm.) as against 0.303 in. of the service rifle, but, as the possible rate of fire is 90 rounds per minute, as an expert can fire 50 aimed shots per minute, and a reservist, say, 25, this decrease in caliber is balanced by the greater amount of ammunition dealt with. The number of rounds carried can be increased by about 25 per cent without addition to the load previously borne. The weight of 10 rounds complete with a clip, which is expendable, is 0.486 lb., and the weight of one cartridge is 302.6 grains. This may be compared with the 7.92 mm. Mauser cartridge which weighs 370.3 grains. The barrel has six rifling grooves, with a uniform twist of one turn in 9 in. The muzzle velocity is 2,700 ft. per second.

FIG. 1. GENERAL VIEW OF RIFLE

FIG. 2. PLAN VIEW SHOWING BREECH BLOCK CLOSED

The rear part of the barrel is air-cooled by means of helical fins, and is kept from contact with the hand by a light perforated cover. This is more clearly visible in Fig. 3, in which the operation of loading is shown. Below the cover the stock is formed with a gripping groove, making the rifle very comfortable to hold. The cartridge clip is loaded by a simple downward pressure of the thumb, and is automatically ejected when the ten rounds have been fired leaving the breach open in the position shown in Fig. 4, thus drawing attention to the fact that reloading is necessary. Incidentally, the breech flies open into this position at the firing of every shot, thus apparently obscuring the back sight. Paradoxical as it may appear, however, this action, which is followed by immediate and automatic closing, does not interfere with aiming in any way, due to its rapidity and the natural phenomenon of persistence of vision. The mechanism depends upon the contact of rolling surfaces, and is therefore not easily chocked with sand or mud, a factor conducing to reliability under almost any conditions. The back sight, seen immediately behind the breech block in Fig. 4, is of the aperture type, the bar perforated with the aperture being capable of being moved transversely either way, for wind allowance, by an indexed thumbscrew on the right hand. Alteration for elevation is effected by a large vertical thumbscrew, with an index and formed with a helical milled ridge to ensure a proper grip. It is graduated to 1,000 meters. This sight can be adjusted both for wind and elevation with the right hand without removing the rifle from the shoulder. The foresight is equally novel. It is of the bead type, but is carried on a bridge so that there is a view below the bead, as well as above it, a property which should be particularly valuable when using the gun against a moving object, such as aircraft. This sight does not interfere with the fitting of a bayonet of any desired type.

As regards the performance of the rifle, we recently had the opportunity of witnessing a test on the National Rifle Association ranges at Bisley, in which three men took part. Each fired about 180 rounds, beginning at a range of 500 yards, and then running forward 100 yards and again firing, repeating this until a range of 100 yards was reached. The best score was 85 bulls, 53 inners, and 37 outers, and the worst was 50 bulls, 60 inners, and 43 outers. In rapid firing for one minute at 100 yards one of the men made 62 bulls, 4 inners, 1 outer, and 1 miss, a total of 68 shots. The recoil of the rifle was low, and it would appear that apart from the reduction in fatigue effected by this there is less tendency for the firer to

FIG. 3. INSERTION OF LOADED CARTRIDGE CLIP

FIG. 4. EJECTION OF EMPTY CARTRIDGE CLIP

lose his target between shots; while the elimination of frequent loading and bolt manipulation, reduces the number of times the target has to be picked up, and so conduces to a saving in ammunition by a smaller number of wasted rounds. Examination of the trajectory curve shows that this is flatter than that of the 7.92 mm. Mauser rifle, while the remaining velocity at a range of 1,000 meters is 1,120 ft. per second as against the Mauser rate of 925 ft. per second for the same range.

FRANCE

Naval Experts Again Favoring Dreadnought Type

The Baltimore *Sun*, By Hector C. Bywater.—After prolonged cogitation the French naval staff, according to a well-informed Paris correspondent, has definitely decided that France must make use of the 70,000 tons of capital ship replacement tonnage which was allotted to her under the Washington and London naval pacts. In reaching this important decision the authorities, as they readily admit, were influenced mainly by the German "pocket battleships," the first of which, *Ersatz Preussen*, may be ready for service by the end of next year. These ships, it will be remembered, combine the armament of a battleship (six 11-inch guns), with a cruiser speed of 26 knots and an immense radius of action, all these qualities being embodied in a vessel of 10,000 tons.

It has long been evident that the 10,000-ton treaty type cruiser, with an 8-inch battery, is no match for an *Ersatz Preusen*. French naval experts, with their painful memories of the *Goeben* in the Mediterranean and their inability to trap that elusive ship, think they have special reason to fear the advent of the new pocket battleships.

Since the war strength of the national army could not be attained without the prompt arrival of the divisions stationed in northern Africa, and since these troops could not be shipped to France unless the sea routes were safe, the building of ships sufficiently powerful and speedy enough to neutralize enemy craft of the *Ersatz Preussen* type is regarded as a military necessity of the last importance.

To make assurance doubly sure the French experts have designed a "reply" type, which in fighting power will be immeasurably superior to the German ship. It is a battle cruiser of 23,333 tons and a speed of 28 knots. She will be steam driven, but to increase her radius of action a Diesel engine, for use at cruising speed, is to be installed. The armament, still under consideration, will consist of 13.4-inch guns, probably eight in number. Protection is to be as complete as possible and much more robust than that of the *Ersatz Preussen*. If the Chamber can be persuaded to advance the money three of these battle cruisers are to be built before 1936.

That they will be constructed is highly probable, since the most thrifty Frenchman is ready to part with his money when there is any question of countering the German "menace."

For several reasons the French decision to resume the building of capital ships is of interest. Paris has long been the stronghold of antibattleship policy and its capitulation is a blow to the *Jeune Ecole*, whose principles of naval defense by light craft and submarines alone have thus been officially repudiated. The doctrinaires have been defeated by inexorable facts. Probably the "war game" board has played its part in bringing about this drastic change of policy, just as it was a weighty factor in confirming the admiralties of Britain, America, and Japan in their resolve to retain their dreadnought squadrons.

Cruisers, fast destroyers, submarines and aircraft are formidable weapons, but their efficacy against highly mobile capital ships, even in narrow seas, has yet to be demonstrated. On the high seas mastodon must be met by mastodon and not by mosquito craft alone. A nation apprehensive for its safety cannot afford to found its defensive system on theories, however plausible they may be.

The news from Paris follows on the heels of an announcement that Admiral Sir Herbert Richmond has been "shelved" by the British Admiralty on account of his heretical views as to naval building policy. Sir Herbert, who is both a distinguished sailor and intellectual in the best sense of the word, is chief exponent of the modernist school—equivalent to the French *Jeune Ecole*—in British naval circles. He has long urged a return to small dimensions, and has recently gone on record as fixing the limit at 10,000 tons.

So far as I know, he is one of the very few British naval officers of high rank who takes that view. The majority, while acknowledging the enormous cost of a modern dreadnought, point out the technical impossibility of incorporating in a 10,000-ton hull combatant qualities in any degree comparable to those, say, of a *Nelson*, a *Maryland* or a *Nagato*.

The design of the *Ersatz Preussen* is hardly relevant to the question. This vessel is in many respects a "freak" ship, which may or may not prove a success. Our German friends are investing $20,000,000 in an experiment, and their enterprise is to be commended. But nations with a bigger stake on the seas cannot afford such experiments.

I have never believed that the dreadnought type would be scrapped except by mutual agreement. And if the three leading powers are all keeping their battleships from motives of prudence—on the principle that heavy metal must be counterbalanced by equal weight—what point would there be in one of them, when the time comes for replacement, laying down a 10,000-ton ship while the others were starting vessels of 35,000 tons and thrice as much fighting power? Such a policy would be fatuous and would never appeal to the cool heads that control naval administration in London, Washington, and Tokyo.

On the other hand, it is quite on the cards that the ponderous dreadnought may become extinct in consequence of international agreement. The question may be raised at the next conference in 1936, though it is by no means certain to be settled there and then. All three of the big powers, in reviewing their naval requirements, have to consider the problem from the angle of oceanic strategy, not merely from the aspect of coastal defense or the protection of short and well-defined routes in confined waters.

That is why American naval experts have resisted every attempt to reduce the Washington treaty standards of tonnage. The small ship, they argue, may be useful enough to a navy which has numerous and well-situated bases abroad, but is of limited value to a navy which lacks this asset. There is cogency in the argument, though it is sometimes pushed to extreme lengths.

But if, in the course of time, the perfection of the internal-combustion engine, side by side with progress in the science of metallurgy and the art of shipbuilding, should render it feasible to endow relatively small ships with high speed, a wide radius and a potent battery, the principal objection to reduced displacement will disappear, and we may then come down to battleships, if not of 10,000 tons, at least very considerably smaller than the standard dreadnought of today.

It may be added that the French decision to build battle cruisers will do nothing to relax the present politico-naval friction in the Mediterranean, for it has just been announced at Rome that Italy will adopt a "keel-for-keel" policy if France should resume the construction of capital ships.

New Cruiser

London *Times*, December 1.—The keel is to be laid at Brest today of the cruiser *Algérie*, the seventh of the post-Washington 10,000-ton cruisers in the French Navy. She will differ in design from the earlier vessels in having a lower speed and better protection. A 6-in. armor belt is spoken of, and the maximum designed speed will be 32 instead of 33 knots. Of the earlier ships, the *Duquesne*, *Tourville*, *Suffren*, and *Colbert* are completed; the *Foch* is nearly ready; and the *Dupleix* was launched on October 9 last. France also has in hand, due for completion next year, the training cruiser *Jeanne d'Arc*, of about 6,500 tons, with an armament of eight 6.1-in. guns.

GERMANY

Naval Building Program

Naval and Military Record, November 19.—No doubt it was merely a matter of coincidence that, as the futile Preparatory Disarmament Commission was once again assembling at Geneva, the German Navy Estimates for 1930 should have been made public. These disclose that the so-called "pocket battleship," *Ersatz Preussen*, will be completed at the Deutsche Werke Yard, Kiel, in 1932, by which time she will have been some four years under construction, and that three more vessels of the same type are to be built. They will be the *Ersatz Lothengrin*, to be laid down next year; the *Ersatz Braunschweig*, to be laid down in

1932, and the *Ersatz Elsass,* not to be laid down until 1936. The remaining items of the program are of comparatively minor interest. On the whole, the German government is showing moderation in its proposals, since under the Versailles Treaty, it might have had six replacement battleships built or under construction by 1936. Possibly, there is a desire to gain experience with the new and very experimental type before undertaking construction of the full permitted quota, for there is nothing to prevent Germany from laying down another two such ships before 1936 if she decides to do so. Incidentally, the cost of these vessels is officially disclosed at £3,750,000, or £375 per ton of standard displacement. They are thus by far the most expensive warships ever built.

In this country the German building program will be regarded with nothing more than casual interest. In naval circles there may be a disposition to wonder just how far the ships may present new tactical problems. It is estimated that their Diesel engines will give them a full speed of 26 knots, but this yet has to be proved. In practice it is doubtful whether they will prove any faster than our *Queen Elizabeths,* and in bad weather not so fast. Therefore, we may reasonably reckon upon possessing five battleships and three battle cruisers (after the *Tiger* has gone) capable of hunting them down. On the other hand, they will have a remarkable sea-keeping endurance, estimated up to 20,000 miles at economic speed, and far in excess of that of any of our capital ships at full speed. Their 11-inch guns are said to outrange any of the weapons employed at Jutland, but in the comparison with our capital ships we must remember that they would be using their guns against armored vessels, while their own very lightly protected hulls would have to withstand the smashing blows of 15-inch shells.

HOLLAND

Destroyer Program Completed

The Engineer, November 21.—The recent satisfactory trials of the destroyer *Van Ness* on the measured mile at Skelmorlie, which vessel was built for the Royal Netherlands Navy by Burgerhouts Shipbuilding and Engineering Company, of Rotterdam, marks the completion of a very successful destroyer-building program. We may recall that in 1926 the Netherlands government decided to build eight destroyers to the designs of Yarrow and Company, Ltd., of Scotstoun. The program was carried through in two sections and of the first four ships, the *De Reuter* was built at the Royal de Schelde yards, Flushing, while Messrs. Burgerhouts constructed three ships, the *Evertsen,* the *Piet Hien,* and the *Kortenaer.* Each of the ships is propelled by a twin-screw arrangement of Parsons turbines, steam being supplied by three Yarrow boilers working at a pressure of 275 lb. per square inch and 610 degrees F. steam temperature. The second half of the program comprised the building of a further four ships, of which the *Van Galen* and the *Witte de With* were built by the Fijnoord Company, of Rotterdam, and the *Banckert* and *Van Ness* by Messrs. Burgerhouts. In these four ships high-pressure, high-temperature turbine machinery was installed, the working boiler pressure being 400 lb. per square inch, with 685 degrees F. total steam temperature. The trials have shown a decided increase in economy, compared with the first four ships, which bears out the good results obtained in recent liners such as the *Viceroy of India* and in the C.P.R. *Duchess* and *Empress* liners, in which high-pressure boilers have been installed. The eight destroyers above mentioned were all built to Yarrow's design and under the firm's technical advice.

JUGOSLAVIA

The New Flotilla Leader

The Engineer, November 7.—The new flotilla leader for the Royal Jugoslavian government, which has been ordered from Yarrow and Company, Ltd., of Scotstoun, Glasgow, bears the distinction of being the largest and most powerful ocean-going vessel of this type yet built in this country, either for the British or any foreign navy. We are indebted to the builders for the following information concerning this interesting vessel. Her displacement will be about 2,400 tons, and she will have a length of 371 ft. 6 in., a beam of 35 ft., and a depth of 22 ft. 9 in. She will be propelled by a twin-screw arrangement of geared turbines, the whole of the power being transmitted through single-reduction gearing of the double helical type. Special care will be taken to balance

dynamically the turbine rotors and gearing to avoid vibration and obtain smooth running. The designed output of the turbines will be about 42,000-shaft horsepower. Steam will be supplied from three boilers of the latest Yarrow water-tube type, with the firm's own design of superheaters and air heaters. The main armament of the new destroyer is to include four 5.5-in. guns and two triple torpedo tubes. All parts of the ship are to be fitted with the most modern equipment, and with a view to service in hot climates, very roomy and comfortable accommodation is to be provided. The order for the ship was placed at the end of last year, and the work on her hull and machinery is now well in hand.

MERCHANT MARINE

Recommendations to Aid U. S. Shipping

The Nautical Gazette, December 6.—Readjustment of American shipping laws to meet conditions confronting the American merchant marine is strongly urged by the United States Shipping Board in its fourteenth annual report as submitted to Congress December 1. The board recommends that the rates of mail compensation authorized under the Jones-White Act be revised to provide higher pay for vessels in excess of 24-knot speed, and that the principles embodied in the so-called White Clarification Amendment, which provided for the award of mail contracts to purchasers of Shipping Board lines, be enacted into law.

In this report the board is able to point out specific progress which has been made in strengthening and improving American shipping, along the lines directed by the Jones-White Act. At the close of the fiscal year (June 30, 1930), the board had authorized loans to twenty-two steamship companies for the construction of forty-nine new vessels and for the conversion or improvement of thirteen vessels. These authorized loans totaled $114,564,715, of which $43,050,890 was advanced before June 30. Since that date the total amount of loans authorized has been increased to $131,793,003.25.

New developments during the fiscal year also included the consideration of three routes hitherto not served by American-flag steamship lines as routes essential to American foreign commerce, as provided by Section 7 of the Merchant Marine Act of 1920. These routes are as follows: Baltimore and Hampton Roads to Bremen and Hamburg; Pacific Coast to European ports; and Pacific Coast to South Africa. The first of these has been certified by the board as an essential route, and, following negotiations with the Roosevelt Steamship Company of New York, the board has sold that company five large steel freighters to be converted into combination passenger and cargo vessels for the inauguration of this service next year. The line will be known as the Baltimore Mail Steamship Company, and will be operated under an ocean mail contract awarded the Roosevelt company.

The second of the above routes has been under the board's consideration for several months. In September, 1929, the board sought bids from private companies for the purchase of vessels to be used in creation of a Pacific-European line. Offers were received for operation under Shipping Board ownership, but there was no bid looking to the establishment of the service with private capital. Since that time, however, the Interocean Steamship Corporation has established regular direct service over this route with sailings every twenty-six days.

The last-mentioned essential trade route is now being served by the Pacific South African Line operated by the South African Dispatch Line, of San Francisco, with vessels chartered from the Shipping Board. The movement of cargo over this route has advanced sharply since the service was established in September, 1929.

The legislative recommendations of the board are to some extent renewals of suggestions put forward in previous reports, but all are designed expressly to relieve private American steamship companies from existing handicaps in their competition with lines of other flags. In the case of one of these recommendations, that which would provide assurance of mail contracts to purchasers of Shipping Board lines, it is anticipated by the board that its enactment into law would greatly hasten the board's progress in transferring government-owned lines to private American ownership. A bill covering such a program was passed in the House of Representatives during the last session of Congress but failed of enactment in the Senate.

In connection with mail pay rates for vessels of higher speeds, the board declares that mail pay for this class of ships (in excess

of 24-knot speed) should be commensurate with the increased differential in cost of operating vessels of the higher speeds.

The board also recommends that American lines, which operate foreign-flag ships in competition with American vessels, should not be entitled to receive mail contract benefits of the Jones-White law. A bill to this effect also was passed in the House last session, but failed in the Senate.

Further recommendations contained in the Board's report are as follows:

Provision should be made for tax exemption on American vessels operating in foreign trade, including a provision whereby deductions shall be allowed from taxable incomes derived from operating profits to the extent that such profits are devoted to new ship construction in American yards.

Legislation should be enacted looking to the transfer to privately owned American shipping interests of the peace-time business now handled by Navy and Army transports and by the vessels owned and chartered by the Panama Railroad Steamship Line.

Funds should be appropriated to carry into effect the act of Congress approved February 23, 1925, providing for the creation of a naval reserve.

Some form of government aid should be provided for American cargo ships, not benefited by mail contracts, in order to lower the operating differential which now handicaps these vessels in competing with ships owned and operated by foreigners.

Proposals have frequently been made to establish "free ports" or foreign trade zones in ports of the United States, and several bills to that end have been introduced in Congress. In view of differences of opinion as to whether or not the establishment of these zones would benefit American shipping, it might well be considered whether their establishment in this country, if sanctioned by Congress, should not first be undertaken on a limited scale under direct authority of the federal government.

The method of determining the rate of interest on construction loans should be fixed more definitely in order to secure uniformity in rate to borrowers of these long-term loans. The matter is now before Congress and it is hoped that favorable action may be taken at the next session.

It is recommended that the limitation of $150,000,000 on the amount of construction loans as prescribed in the second deficiency act, fiscal year 1928, page 7, be removed, and that the Shipping Board be authorized to enter into contracts to make loans up to the ultimate amount of the fund, namely, $250,000,000, the board, however, not to obligate itself to make actual disbursements of money in excess of the available cash balance standing at the time to the credit of said fund.

It is recommended that section 11 (a), Merchant Marine Act, 1920, be further amended to provide that the contributions to the construction loan fund by the United States Shipping Board be permitted to continue until such sums, plus appropriations by Congress, reach the maximum of $250,000,000 provided by section 302 (b), Merchant Marine Act of 1928.

Changes should be made in the present laws relating to the division of damages in cases of collisions of vessels at sea, to conform to the proposals of the International Marine Convention of 1910. These changes should be brought about by legislation rather than by treaty.

Recommendation is made that legislation looking to the adoption of The Hague Rules, substantially as provided in H.R. 3830, Seventy-first Congress, should be enacted at an early date.

The International Convention for Safety of Life at Sea, signed in London on May 31, 1929, by delegates from eighteen governments, including the government of the United States, should be ratified and given full effect by Congress.

Undeterred by the general business depression, the board states, American shipowners are augmenting their fleets in order to be in a strategic competitive position when normal conditions again prevail.

A New Era?

The Nautical Gazette, November 22.—Lloyd Sabaudo seems destined not only to throw a bombshell into the lively transatlantic arena of passenger-line competition, but to usher in a new era in passenger comfort. All must agree that the shipping event of greatest universal human interest in years was the announcement this week that Lloyd Sabaudo's new superluxury liner *Conti di Savoia* would be virtually prevented from rolling at sea by three Sperry gyroscopic stabilizers costing $1,000,000.

Stabilizers have been used on yachts and even on a 10,000-ton airplane carrier; and the Germans have used Framm antirolling tanks to considerable extent and with varying success on passenger vessels; but never before have the owners of a commercial ship seen the economic advantage of installing rather costly stabilizers to limit the roll of a ship to five degrees—practically nothing.

In making the announcement, Colonal M. Serrati, the company's director in the United States, pointed out that "there are still too many people right here in America who are eager to go to Europe, but who hold back because of fear of discomfort or illness from a rough crossing." His company was the first "to go to the heart of the problem" by installing a "mechanical giant with the power to hold the decks level in the roughest weather."

This Italian line has started something. The *Bremen* and the *Europa* captured the

speed record. But the *Conte di Savoia* and the new *Rex* of the N.G.I. not only will have 27.5-knots speed, but promise to get the jump in luxury and comfort. Now it is a question what the other lines, such as United States, Cunard, White Star, and French will do with their new ships already projected in the race.

The main consideration of owners is, of course, an economic one—whether passenger revenue will increase enough to warrant the expense of installing stabilizers. Will the investment give a fair return? Evidently Lloyd Sabaudo believes the $1,000,000 expense is worth it in the case of its new ship. It evidently believes the elimination of rolling is the main thing, and that the pitching of an 820-ft. hull spanning and cutting through the average waves at high speed is negligible. Whether installations on shorter and slower ships will always give as great a degree of effectiveness in all kinds of confused seas—such as those producing a combined heavy roll and pitch—may be another question; but one in which we are not concerned here.

If, however, all the luxury superliners should install stabilizers, the lines will have an extra investment running into the millions, and all will again be on a par as a to sea motion. So the final result may be considerable increase in traffic on all lines—the public paying for the extra comfort, with or without an increase in fares. At any rate the public owes a great debt of gratitude to the late Dr. Sperry, whose inventive genius has proven of invaluable benefit to mankind in more ways than one.

The three gyroscopic stabilizers on the *Conte di Savoia* will each weigh 100 tons and measure 13 feet in diameter (rotors only). These will be fitted in the lower hold about under the bridge, and each stabilizer will be actuated by a small 50-pound gyroscope set in the wing of the hull. The amount of gyroscopic force may be realized from the fact that 300 tons of steel in gyroscopic motion can effectively control the sea motion of a vessel of over 50,000 tons.

Each gyro wheel weighing 100 tons requires to operate it as a stabilizer an electrical energy equal to 560 hp. The total power required to operate all three stabilizers in bad weather is nominally 1,500 hp., although the maximum capacity of all the electric driving motors is 1,830 hp. In all likelihood the generators for auxiliary purposes in this ship will be Diesel driven, as on the *Europa* and *Bremen*, and therefore the fuel cost of the 1,500 hp. in operating all three gyros for a continuous period of twenty-four hours should not exceed $60 per day.

The principle of the gyro is that of the spinning top and is really not difficult to understand. Its stabilizing action is based upon what is called precession, which is that when any force is applied changing the plane of a spinning gyro wheel, a force is created at right angles to the applied force. The operation of a stabilizing set is as follows: The small control gyro precesses—due to the initial changes in the ship's rolling motion—around a vertical axis (the shaft of the gyro wheel being horizontal fore and aft); and by electrical circuits and a magnetic brake, controls the main precession motor, which, through a mechanical gear, tilts fore and aft the vertical shaft of the main gyro whose rotor precesses around a horizontal axis. The main gyro casing rests in two large gudgeon bearings athwartship over the centerline of the vessel, and since the precession exerts force at right angles to the applied force, the result from the main gyro is a force acting directly down on one bearing and up on the other, thus counteracting the motion of the vessel. Both gyro rotors are, of course, driven by an electric motor. The precession of the small control gyro is arranged to give movement between a gap on either side of which is an electrical contact for the circuits controlling operation of the main precession motor.

ENGINEERING

The Development of Echo Sounding

The Shipbuilder, December 1.—During the past year, there has been a rapid development in the use of echo sounding apparatus. It is now about five years ago that the principle had its inception, and during the intervening period every phase has been experimented with. The name of Messrs. Henry Hughes and Son, Ltd., has been prominently associated with this development, and, as is now well known, their instruments have been adopted, to an exceptional extent in the British Navy as well as for numerous important vessels in the merchant service. Its value to cable ships and in connection with survey work is obvious.

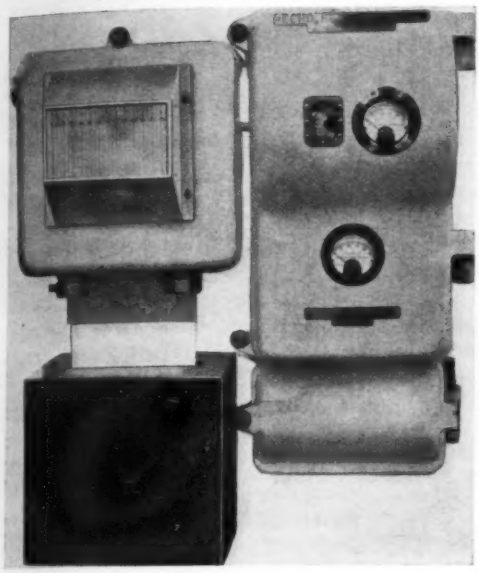


FIG. 1.

Up to the present, however, the application of the gear has been dependent upon observation either by ear or eye. Neither of these methods is automatic, and neither fully meets the maximum requirements of the navigator or surveyor. Messrs. Hughes, recognizing this limitation, have been investigating the possibility of producing an instrument which would effectively remove it, by making an autographic record of the contour of the sea bottom. Some arrangement of the kind has been made in the French echo-sounding equipment; but, owing to its complex and expensive character, it has not found wide application. Messrs. Hughes are to be congratulated on their solution of the problem, which is both simple and accurate, and which enables short or long series of soundings by echo to be made and a visible record of the bottom to be obtained. The soundings can be made at the rate of forty-five per minute, equivalent to sixty per inch of the autographic record, and a very fine and accurate contour line results.

A photograph of the receiving unit and recording apparatus is reproduced in Fig. 1. The latter consists of a drum, over which a paper, moistened by a suitable chemical solution, is passed. The drum is the positive pole of the microphone circuit, and the pen, which passes across the moist paper, is the negative pole. The variation of current created by the echo reaching the microphone causes a discoloration of the paper at the echo point. A zero line is marked on the record, and a scale enables the depth to be read off. A reproduction of a portion of a chart taken by the Hughes installation in the new Union-Castle liner *Winchester Castle* is given in Fig. 2, with the appropriate scale of fathoms.

The new apparatus will greatly extend the use of echo sounding, as the navigator or surveyor is able to make his own charts on any particular run the first time he takes his ship there. He is given a clear idea of the nature of the sea bed, and of those features upon which he can rely for future observations and location of position.

It may be said that the recording apparatus will be practically indispensable in survey work, as the rapidity with which observations may be taken will be enormously increased. Records may be taken for either long or short periods; and the moment the chart has passed through the drying chamber, the actual contour line can be studied and any part to be resurveyed immediately seen. The increased accuracy obtained by the large number of soundings taken and the precise time marking will also be of great advantage.

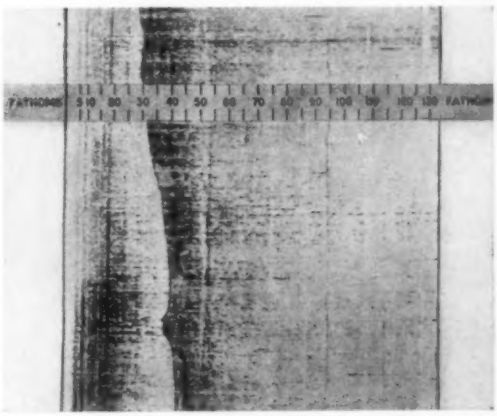


FIG. 2.

Head phones may be used in conjunction with the apparatus if desired, an accurate check on the recorded sounding being thereby obtained.

With reference to sounding at very great depths, the apparatus has given a high de-

gree of accuracy; but is it universally agreed that, for deep-water work, sounding by ear is the most accurate. This does not, of course, prevent the use of the recorder; and it is hoped that, in the near future, the apparatus will be utilized to read up to four hundred fathoms.

In conclusion, it may be mentioned that the new apparatus is known officially as the British Admiralty Type No. 752.

AVIATION

International Plane License Agreements

New York *Herald Tribune*, December 7.—The present status of international aviation agreements is such that a plane which may be licensed as airworthy in one country might be denied official government approval to fly in another.

The United States government soon will undertake negotiations with other countries for reciprocal relations concerning aircraft licenses.

At present the United States has such agreements only with Canada and Columbia. The agreement with Canada provides that certificates of airworthiness on aircraft built in Canada and exported to the United States will be accepted by the United States if issued by the Department of National Defense of the Dominion in accordance with the latter's requirements. Canada recognizes American licenses issued under the same conditions.

In dealing with all other countries, Columbia excepted, this country issues airworthy certificates on planes to be exported, but these are not definite assurances that such aircraft will be accepted as airworthy upon their arrival at their destination.

Certificates of airworthiness on craft for export are issued only when the craft is approved by the Bureau of Aëronautics. In the event that a manufacturer should desire to export an airplane to any foreign country, where no reciprocal agreement is in effect, a certificate of airworthiness will be issued by the bureau upon application by the manufacturer or recorded owner, presuming that the aircraft is of a type eligible for export and conforms with the airworthiness requirements of this country.

It is in the matter of manufacturing practices that the greatest confusion has developed in defining what constitutes an airworthy airplane. In many countries the use of welded-steel tubing for fuselage construction is not approved as a safe practice.

Despite the absence of many international aircraft agreements, representatives of this country have sought to keep the export and import relations "in the best order possible" in anticipation of making further agreements which will permit the issuance of export certificates "in blank."

An example is the ruling by the Bureau of Aëronautics that where foreign owned aircraft of American manufacture are returned to the United States for repairs or remodeling from one approved type to another, a superseding certificate of airworthiness covering the aircraft as remodeled or repaired must be obtained from the government.

Planned Army Air Corps Exercises

New York *Herald Tribune*, December 21.—The Army Air Corps has completed tentative plans for the greatest concentration of military aircraft ever made, either in war or peace time, for the annual spring maneuvers of the corps to be held next May, and which will center around New York. The air war games, which have never before been held on the Atlantic seaboard, will bring here an air fleet nearly four times larger than any which has heretofore visited the city.

This air movement is to be on such a gigantic scale that it will be necessary to utilize commercial aviation bases in the metropolitan district to house and service the planes—more than five hundred of them—which are to be assembled here from military air posts throughout the country. The largest single previous concentration of airplanes over New York was the fleet of 138 planes which visited the city last June.

F. Trubee Davison, Assistant Secretary of War for Aëronautics, feels that the occasion of using commercial airports in these maneuvers gives the department a splendid opportunity to discover what reliance can be placed upon such civilian air depots in time of a national crisis. "Obviously," Secretary Davison points out, "it will be impossible to base 500 planes and 1,100 pilots and enlisted men at one post, such as Mitchell Field. The commercial airports, therefore, will be called upon to perform functions they would have to perform in time of war if our coast should be attacked."

In explaining the purposes of the 1931 exercises, Mr. Davison said:

Dramatic and comprehensive tests to determine the ability of the Army Air Corps to meet a major coast defense emergency will take place along the northern section of the Atlantic seaboard in May, 1931, when about 500 Army planes and approximately 1,100 Air Corps pilots and enlisted men will be concentrated at New York, Boston, Philadelphia, Baltimore, Wilmington, Washington and other points along the Atlantic seaboard to participate in the annual Army Air Corps Field Exercises.

This is the first time in the history of American military aviation in time of peace that so many planes will be concentrated for the testing of tactical problems over a territory that covers more than 100,000 square miles and almost a dozen states. It is also the first time that large scale Air Corps exercises are being held on the Atlantic coast. The territory over which tactical and other military air problems will be conducted runs, roughly speaking, north and south from Boston to Norfolk and as far west as Buffalo and Pittsburgh. In this manner the field exercises will afford a practical test of the military usefulness of scores of airports within the area mentioned.

The field exercises will have a three-fold purpose: First, training and operation of a large number of units; second, unit combat training; and third, supply ground and staff problems. All tactical squadrons in the United States from North, South, and West, will be summoned to serve in this major mimic air war, as will, perhaps, representatives from the various National Guard squadrons. It is also planned to call a large number of reserve officers to active duty for the "duration of the war," including numerous distinguished pilots no longer in military service, who may be willing to take a refresher course.

The Blackburn "Sydney" Flying Boat

Aëroplane, November 22.—The Blackburn *Sydney,* the largest military monoplane flying boat in this country, is designed to undertake the same duties as the well-known Blackburn *Iris* type, namely reconnaissance and coastal patrol, either independently or in coöperation with sea craft, and it is arranged to carry a similar crew and military load.

The *Sydney* is a high-wing semicantilever monoplane, and is constructed entirely of metal, with the exception of fabric covering on the wing and tail-unit. The hull, like that of the *Iris,* has a deep forefront and is well flared to keep down spray. In the *Sydney,* however, the sides of the hull above the water line are nearly perpendicular, whereas those of the *Iris* slope towards the deck at a noticeable angle. As a result, in spite of less beam in the *Sydney,* the interior is much more roomy. From the second step the lines sweep upward to the stern, in which a tail-defence machine-gun station is provided behind the center rudder.

The center-section wing is supported above the hull by a steel tubular structure built up on the hull and faired to form a streamline nacelle, and two pairs of sloping struts brace the extremeties of the center section to the hull. The outer wing sections taper to the tips in both plan and elevation. The whole wing on each side of the hull has a noticeable dihedral angle. Wing floats are set comparatively close to the hull and are supported from the center plane by two pairs of struts which bisect the wing-bracing struts.

The tail plane is a braced monoplane and is fitted with trimming and controlling elevators. No fins are fitted, and the three rudders, which are unbraced externally, incorporate servo control, which can be engaged or disengaged as required.

Three 525 hp. Rolls-Royce F.XII M.S. engines are mounted in nacelles, which are faired into the top of the leading edge of the center section of the wings. Each unit includes a water tank, radiator and shutters, and oil tank and cooler. The main petrol tanks are carried in the faired structure between the hull and wing and fuel is supplied by engine pumps through a distributor control.

Accommodation is arranged for a normal crew of five comprising pilot, second pilot navigator, wireless operator, engineer, and gunner. Three machine-gun stations are provided, namely, a bow cockpit, an aft cockpit behind the wing and a tail-defense cockpit in the stern. The pilot's cockpit has side-by-side dual control and is enclosed with sliding side windows and roof panels. In the interior the forward portion contains navigator's and wireless operator's stations and officers' living and sleeping quarters. Further aft are the engineer's station, men's sleeping quarters, enclosed lavatory, galley, and storage for supplies, etc.

The Irvin Parachute Harness

Aëroplane, November 26.—Up to the present parachutes have not been used in the Fleet Air Arm of the R.A.F. because of the obvious difficulty of getting out of the present type of harness should an airplane or a seaplane overturn after alighting.

The personnel of the Fleet Air Arm were against wearing any sort of a parachute equipment from which they could not release themselves quickly. This difficulty has al-

ways been recognized by Mr. Leslie Irvin, but to retain the riding qualities of the Irvin-type harness he had to perfect a new design of harness that would retain all the riding qualities of the old type and still have one-point instant release.

The main principals of the new harness, which has now been adopted in the Fleet Air Arm, are as follows:

The same seat-straps, back-straps and leg-straps are used as in the standard type, but these have been so designed that they are all connected together at one point in front of the wearer. Should he wish to remove himself from the harness he has only to turn and release one fitting, and then he is free of any straps connected to the harness.

Another feature of this new harness is the fact that a back-pad which holds the harness in shape makes getting into the harness after getting into the airplane much easier. In other words, the parachute can be put in the cockpit and then the pilot can get into the harness in the airplane much more easily than he could put on his harness before entering the plane.

This new-type harness can be used with seat, back and quick-connector type parachutes, and there is no increase of weight.

This new harness has been found to be more comfortable to wear, and with the new type of webbing, which is much softer than the old type, there is no doubt that it will become standardized in the future for all types of aircraft.

Exhaustive tests have been made by the Air Ministry, and they have placed a substantial order with the Irving Air Chute of Great Britain Ltd., of Letchworth, Herts., to equip the Fleet Air Arm immediately. This new type of harness has been very favorably received in various European countries, and substantial orders have been given by foreign governments.

British Aircraft Carrier Assignments

Aëroplane, December 10.—H.M.S. *Hermes* arrived home from China on September 24, paid off, and recommissioned at Chatham and sailed for China on November 11, where she will resume normal routine flying duties in conjunction with other ships on the China station.

H.M.S. *Eagle* has been engaged on normal duties with the Mediterranean Fleet.

H.M.S. *Argus* is now in reserve.

H.M.S. *Furious* arrived at Devonport on September 29 and is now undergoing a long refit.

H.M.S. *Courageous* maintained normal routine flying duties with the Atlantic Fleet on the Autumn cruise and took part in the naval exercises on the occasion of the visit of the Dominion Premiers to the fleet at Portland.

H.M.S. *Glorious* completed extensive repairs at Malta on November 15 and will now resume normal routine flying with the Mediterranean Fleet.

New Plane Equipment for R.A.F.

Army, Navy, and Air Force Gazette, November 27.—During the next fifteen months some ten squadrons of the Royal Air Force will be equipped with aircraft of the latest types. About 250 machines of various types are to be ordered forthwith. Six squadrons will be equipped with the Hawker *Fury* (late *Hornet*) interceptor fighter. Four squadrons are to have Hawker *Harts.*

The fact which has been known for some time that two of the new productions of the Hawker Engineering Company, the single-seater fighter *Hornet* and the two-seater bomber *Hart,* have been adopted for service with the Fleet Air Arm in replacement of present standard types is now authoritatively admitted. There seemed hardly a doubt about it when these types were shown to the dominion prime minister at Croydon last month in what may be described as a naval setting, one machine having been brought from H.M.S. *Hermes;* but the official explanation was that the types were still under trial and test, in company with others. Production orders have now been placed. The fleet version of the *Hornet,* in accordance with the Air Ministry scheme of nomenclature, will be called the *Norn,* just as the land version is renamed the *Fury.* The new name of the naval version of the *Hart* bomber is not yet announced. The two machines have been strengthened to withstand the stress of deck landings and use from catapults, and while this has increased their weight, the speed is not materially reduced.

Aircraft as Supply Vehicles

Army Navy and Air Force Gazette, December 11.—An interesting experiment in the supply of food to a column of troops

on the march, the first of its kind on so large a scale, was carried out on the northwest frontier of India in September with a high degree of success. The details, which have just been released by the Air Ministry, show that the column, approximately 1,000 strong, started from Dargai for Chitral on September 5, and as an experiment it was decided to ration them completely for two days from the air. The first halt was made between Dargai and Malakand, and the second at Chakdarra. Supplies amounting to a total weight of about three tons each day were required, and two air squadrons of No. 2 (Indian) Wing, at Risalpur, were ordered to transport them. Each squadron consisted of seven *Westland Wapiti* general purpose two-seater airplanes, and four parachute loads were carried in each machine.

Arrived at their halting place, the column marked out a large circle on the ground in which the aircraft were to drop the rations. On the first day forty-eight of the fifty-six loads were successfully parachuted down, most of them falling within the circle of the dropping area. On the second day—profiting no doubt by experience—fifty-four out of the fifty-six loads were successfully dropped at Chakdarra. The outcome was that the troops were fed for two days by the Royal Air Force, the first time in history that so large a military force had been completely rationed from the air. The parachute apparatus worked most successfully. It is designed so that it can take boxes, and any form of load can be used quite easily. The country was not easy for such a test, and the satisfactory outcome of the attempt indicates how, with efficient aircraft cöoperation, the progress of armies may be accelerated.

New Direction Finder for Aircraft

New York *Herald Tribune*, December 28.—A radio direction-finding device which virtually converts all broadcasting stations, radiotelegraph stations and transmitters of a fixed location into beacon stations for aircraft has been developed by Geodfray G. Kruesi, west coast radio engineer. The instrument literally permits pilots to navigate a course by following the beam of a radio program broadcast over a station.

Designed primarily to supplement the usual range beacon apparatus installed aboard commercial planes flying charted airways, the instrument received a practical test recently aboard one of the Western Air Express Company's planes. Kruesi is a research engineer for this company.

In the test, which was conducted between Los Angeles and San Francisco, the pilot, Harlab Hull, followed the radio beam of an Oakland radio station throughout the 400-mile flight by means of the instrument.

Employing a conventional broadcast wave-lengths receiver redesigned for aircraft work, the instrument may be used to fly to any destination where there is a station. Experts point out that the device has an ideal application in addition to its use aboard commercial planes, for guiding privately owned planes over uncharted airways in bad weather. The instrument, it is claimed, virtually converts the entire country into a mass of tangled airways, which may be singled out by knowing the location of broadcasting stations or the nature of their programs and following the radio beam concentrated by the instrument aboard the plane.

While broadcasting stations transmit signals in all directions, the device invented by Kruesi has the ability to determine the direction of the received signal, thereby leading the pilot to the source of the signal. Knowing the station's call letters or program, it is possible for him to arrive over the broadcasting station by following the direction on the instrument.

Technically the instrument consists of a broadcasting station tuner, a direction-finding loop antenna, aerial, and an indicating meter which shows the direction of the broadcasting station. The instrument, it is pointed out, may also be used when tuned to the signals of a radio station other than broadcasting transmitters, although it is necessary to employ a receiving set capable of tuning the wave of the stations being received.

The loop antenna which has directional tuning characteristics, is mounted in a fixed position atop of the fuselage of the plane. Used in conjunction with a small antenna it has the quality of receiving a signal with maximum intensity when the nose of the ship is headed directly toward the broadcasting station. The pilot tunes the aural signal by means of head phones, but actually guides the planes by means of a sensitive meter, which is mounted in the instru-

ment board. This instrument, which acts as a field-intensity meter, is far more sensitive than the human ear. It has markings "L" for left and "R" for right, and a dead center point. When the needle swings to either the left or the right, the pilot knows he is not flying in a direct line toward the broadcasting station, and, accordingly alters his course until the needle rests at dead center, indicating he is flying in the true direction of the station.

While in some respects the instrument is similar to the direction-finding equipment used aboard ocean-going vessels, it differs slightly in operation. The marine direction finder indicates direction of a transmitting station of fixed location by tuning for zero signal. The device developed by Kruesi tunes for maximum signal strength. This enables the pilot to identify the station readily. This quality is described as "heart-effect" tuning, and gives maximum signal strength in only one direction, facilitating flying toward the broadcasting station, rather than away from it.

The coils and accessory instruments, which are connected between the loop antenna and the broadcasting receiver, are the secret of the device, it is said. This equipment permits picking up the signal with maximum intensity, and at the same time retains the directional characteristics.

The Curtiss "Command Helldiver"

Curtiss-Wright *Review,* December.—Something new in naval aircraft has just been developed at the Garden City plant of the Curtiss Aëroplane and Motor Company. A high speed airplane known as the *Command Helldiver* has been built for the use of officers and officials of the Navy in directing maneuvers or for fast cross-country transportation. This airplane is based on the military *Helldiver,* now in service as a two-place carrier fighter and diving bomber where it is officially known as the *Curtiss F8C-5.* Powered with a 575-horsepower Wright Cyclone engine to which the newly developed Curtiss radial-engine cowl has been fitted, the *Command* plane has been timed at 178 miles per hour in the official Navy test at Washington.

The *Command Helldiver* has the same wings, fuselage, landing gear, and tail surfaces as the fighting plane. On the Command airplane, the cockpits have been closed in by sliding metal frames with non-shatterable glass windows. These enclosures have been carefully faired into the fuselage and add considerably to the speed, besides giving protection to the pilot and passenger. Every effort has been made to cut down air resistance. The wheels are enclosed in sheet aluminum fairings of fine workmanship; the landing gear struts are faired; the fuselage conforms to the best aërodynamic shape.

The Curtiss radial engine cowl used on this airplane was developed specially for Wright engines in the Curtiss seven-foot wind tunnel. A feature of this cowl is its simplicity of construction and the ease with which it can be installed or removed. Very gratifying results are being obtained with the cowl on the Cyclone engine. For example, the new Cyclone-powered Curtiss Army Pursuit known as the *YP-20,* which is equipped with the new cowl, has a speed of approximately 190 miles per hour.

THE CURTISS COMMAND HELLDIVER

In working out the details of the *Command Helldiver,* careful thought has been given to the comfort and convenience of the pilot and passenger. The windshield slides forward on a track, making it easy for the pilot to get in or out, and the rear cockpit is equally unobstructed when the glass and metal hood are pushed back. Small folding writing desks are provided for both the pilot and passenger. Cockpits are lined with black leather and the seats and all accessories are painted dull black. Controls are dual and are located for maximum ease of operation. Ventilation which can be regulated is provided for the cockpits. Baggage compartments fitted with locks are installed. For night flying, the airplane is equipped with new type landing lights, sunk into the bottom of the lower wing, having their beams directed forward by means of prisms.

Great structural strength is a feature of the *Helldiver* airplanes. They are built to withstand the terrific strain imposed upon them in service as diving bombers. With a heavy load of bombs, these airplanes are required to make full-power dives of ten thousand feet, followed by quick pull-outs.

With full tanks, the *Command Helldiver* has a cruising range of 885 miles. It is an airplane capable of covering long distances at high speed with no sacrifice of comfort to occupants, and is moreover capable of performing all the maneuvers of the latest type of combat plane.

Aëronautical Courses at Junior Colleges

U. S. Air Services, December.—"Seems as if all our good men go to the junior colleges." Thus lamented the superintendent in charge of ground instruction at one of the largest flying schools in the country recently. He was referring to the way in which the junior colleges in his state had been drawing on his particular school for personnel to teach the courses in aëronautics they are now preparing to give. "They are getting all our good men." Is the cry prophetic of a general tendency to transplant ground instruction from private, commercial institutions to public ones? The answer may well be yes; and if it should be so shall we be called upon to sorrow or rejoice because of it?

The junior colleges are, indeed, ideal ground for the inauguration of sound aëronautical courses. Their advantages for adequate instruction in such a department are so obvious it is cause for wonder that they have not exploited the opportunity to develop them before. The students who attend such colleges are at the most suitable age and in the most receptive frame of mind for intensive study and alert appreciation of the problems involved. They are thirsting for information along this line, and ripe for sound and serious instruction. They are not only at the adventurous age to which aëronautics makes its strenuous appeal, but they are also of sufficiently mature understanding to undertake the study seriously and with due appreciation of the mathematics and physics involved.

Obviously the success of any such program must hinge altogether on the quality of the instruction given. If the instruction is good the results will be assured, because the student material is likely to be of a sort to guarantee assimilation of what is taught. If the quality of instruction is mediocre the course will be either a failure or so diluted a form of success as to constitute it a waste of the student's time and the college's money. Hence the hope embedded in the cry quoted—that the junior colleges in one state at least seem to be draining the commercial flying schools of their best teaching personnel.

Whether this portends a general tendency or is a merely local incident it is not possible at this time to say, but that it is the former may very well be the case. And why? For the reason that, after all, the logical place for systematic teaching of the theoretical principles of flight and of airplane design and operation is in an essentially educational institution. This is not said in disparagement of the many excellent flying schools now in existence; it is rather a simple fact which no doubt most of the flying schools themselves would admit.

The immediate and ultimate object of the flying school is to teach its students to fly. The ground school instruction though absolutely essential is nevertheless incidental to this object. Few flying schools are as well equipped for this branch of instruction as they would like to be, and those that are realize too well the heavy overhead expense the ground school course entails. The student, moreover, not appreciating its importance, shies at the tuition demanded of him

for classroom attendance and booklore when what is uppermost in his thoughts is the flying rather than the theoretical steps leading to it.

Furthermore, to get the most out of his flying instruction, the instruction in theory should precede it and precede it by a good margin. Given a sound course of junior college instruction in the subjects now taught more or less precariously and at considerable cost in the commercial flying schools, the average flying student will approach the actual air work at the flying school not a whit less intelligently and go on to the acquisition of his private, commercial, or transport license, confidently, quickly, and economically. The state will be assuming only what is its proper responsibility while doing much at the same time to make the coming generation "air minded" in the practical and better sense of the word. An opportunity awaits the junior colleges to take an important and far-reaching step in the campaign of legitimate flight promotion.

MISCELLANEOUS

Torpedo Warfare

The Naval and Military Record, November 19. By Sir Herbert Russell.—It is true to say of all the weapons of war—with one exception—that they tend steadily to lose in value in the course of their development. On the one hand, ingenuity gets to work to devise the antidote; on the other hand, progress tends to evolve the weapon beyond its original conception and purpose, so that it passes from the stage of definite function to a vague general rôle. The exception, of course, is the gun. For generations past now armor has been opposed to the artillery projectile. In the competition between increased resistance and greater penetrative power the gun has always kept well ahead. The consequence is that armor to be really effective, now has to be of a thickness, and consequently of a weight, which renders its adequate employment prohibitory in any but very big ships. Sea battles always have been, and I believe, always will be determined by gunfire. Torpedoes, mines, and bombs are all very deadly things, but they represent forms of attack which can be countered very largely by foresight and skill. Gunfire is too swift and too deadly to permit of any effective countering between vessels well within mutual range.

When the torpedo had emerged from its experimental stage and demonstrated its practical qualities it brought into being the torpedo boat. The French, with their keen initiative and love of novelty, adopted the new weapon and the new vessel with such heartiness as to arouse deep misgivings at the Admiralty. The new French school, of the *guerre de course* doctrine, declared that the ironclad was as dead as the dodo, and it was definitely stated in the House of Commons that the ships of the old *Admiral* class might prove to be the last battleships which this country would build. By more moderate opinion in the British Navy the development of the torpedo was welcomed, as it seemed to promise effectually to destroy the exaggerated faith in the ram. The evolution of the torpedo boat stimulated the production of much faster cruisers than had heretofore been deemed necessary, thereby restoring to this unit her temporarily lost supremacy of mobility over the ship-of-the-line. In the closing years of the last century the development of the torpedo was very rapid and relatively outstripped the progress of the gun.

In 1893 the first destroyer made her appearance in the British Fleet. She was named the *Havoc;* had a displacement of 240 tons, engines of 3,500 hp., and the "revolutionary" speed of 26.77 knots was attained during her trials. From this point, what was then called the torpedo branch grew rapidly alike numerically and in presumptive tactical importance. As usual, the probable results of flotilla attacks in naval actions were placed extravagantly high. The Russo-Japanese war afforded demonstration of the effects of torpedo attack against ships unable to avoid it, as at Port Arthur, but in the open sea warfare of that campaign this weapon played a very trifling part. I recall that in the naval maneuvers of 1902 the cruiser squadrons appeared to be a good deal more interested in trying conclusions with torpedoes than in the much easier and more obvious course of fighting at their meetings with gunfire. Apparently it had not then occurred to the Navy as generally as, I believe, is since the case, that torpedo tactics were not the best, even the proper way in which to employ cruisers. The cruiser I was in was "torpedoed" three times in an action before being adjudged sunk,

but the captain of her explained to me very emphatically and, I have no doubt, perfectly correctly, that he was positive he had previously knocked out with gunfire the two ships which, between them, claimed his vessel as destroyed.

The coming of the submarine, of course, gave a much greater measure of value to the torpedo. An invisible boat firing an invisible weapon seemed to herald the doom of the ironclad very much more effectually than the torpedo boat had done two or three decades earlier. Were it possible to raise the same speed in the submarine as in the modern destroyer there would be good reason to dread torpedo attack as infinitely more dangerous than when delivered by surface vessels. But, whether owing to mechanical difficulties or from considerations of worth while, we have not got beyond 20 knots on the surface and 9 knots submerged, and in a running action at top speed, as all naval battles are likely to be fought, the submarine is hopelessly out of the race. I believe that destroyer tactics had much greater chance of success thirty years ago than they have today. An effective range of a mile is a very different proposition from an effective range of seven miles. The destroyer had to dash in pretty close to her target before loosing off her projectile. She had to take her chance of being knocked out during her onrush, and the odds were pretty heavily against her. The same spirit still lives in the destroyer service, but the same necessity is not there. When a vessel can release her torpedo at 14,000 yards why should she wait to approach to within less than 2,000 yards?

The torpedo is primarily a weapon against the weak. The Germans got the fullest possible value out of it in their campaign against defenseless ships. They could have done their work more easily and more economically by gunfire, and much of it was done by gunfire, but they could only do that work at all by the use of vanishing boats. But against the strong—that is to say against warships—the torpedo accomplished amazingly little during the war. Apart from the few "sitters" which were sunk in the early stage of hostilities we did not lose a single big warship from torpedo attacks. The *Marlborough* was hit at Jutland and considerably damaged, but went on fighting until she was no longer able to keep within striking range. Yet the destroyers on both sides were pretty daring at Jutland. Their losses were terribly out of proportion to what they accomplished. Our flotillas were keeping up the tradition of dashing in as close as possible before discharging their torpedoes. They were splendid—magnificent, but in the day action they quite failed to justify Mr. Rudyard Kipling's florid description of them as the "choosers of the slain." How could it have been otherwise? To deliberately send a frail, totally unprotected craft charging against a big ship, which has plenty of time to get off several salvoes from the moment the charge begins until the blow can be delivered, would be called ludicrous—suicidal, were it not that the frail, totally-unprotected craft is a torpedo carrier. Whether this is more clearly realized today, or whether the greatly increased range of the torpedo has modified the close dash idea—for there can be no earthly value in greatly increased range if if it is not employed at greatly increased distances—is, perhaps, not very material. If the fleet exercises are any criterion of war tactics, it would seem that the idea of destroyer attack now is to utilize long range up to the hilt.

This seems sensible. A destroyer which does not approach her target to within less than four or five miles has a very good prospect of delivering her torpedoes and getting away again. But what of the chances of her torpedoes getting home? The modern torpedo is a weapon of wonderful precision. But it will take at least twelve minutes to cover five miles, for although it starts off at about 45 miles an hour, it soon begins to reach that stage known to the experts as "remaining velocity." With her optical instruments a destroyer can set a torpedo dead to strike a ship in twelve minutes' time, calculating that during that twelve minutes the ship will continue precisely the course and speed of the instant of ranging. In twelve minutes the target ship will have traveled between four and five miles. The least fluctuation of engine beat or of direction in that time and the torpedo is wasted. A ship hard pressed in battle and steered under gunfire is scarcely likely to maintain hair's-breadth constancy for twelve minutes on end. In short, the evolution of the torpedo has inevitably minimized its value. A high velocity shell can be pitched across five

miles of water in fifteen second, and is even more deadly accurate than the torpedo.

The destroyer is gradually being adapted to a wider utility than delivering torpedo attack. This rather suggests a relaxation of single-minded faith in the torpedo. But against this assumption we have to set a great extension of torpedo equipment in big warships, notably in the latest cruiser classes. These vessels carry four more torpedo tubes than the latest destroyers. They are more essentially designed for torpedo warfare than destroyers. What really is the tactical idea which lies at the back of this development? What experience during the course of the great war justifies it? Maybe, if we argue that the torpedo is a weapon of diminished, or diminishing value, it is more logical to distribute it generally amongst various types of warships than to dedicate one particular type entirely to employing it. But to furnish a big cruiser with more torpedo tubes than main guns does seem rather an extravagant interpretation of this principle. From the structural point of view such an equipment may be quite a trifling detail, and probably the demand upon space is of much more moment than any question of weight. But from the functional point of view the practice is very much more definitely open to criticism. It implies a scope for cruiser fighting which introduces a complicated feature into the traditional conception of cruiser work, and the question is whether any such complication is justified by possible results. It involves a very substantial complement of torpedo officers and torpedo ratings who, admittedly, specialize generally in electrical matters and do their best to make themselves useful in a ship, occasionally coming in conflict with the engineering people in their well-intentioned zeal.

I am aware that other great naval powers are following the same idea and equipping their cruisers as glorified destroyers. But I am also aware that a very large and competent body of opinion in our own Navy deprecates entirely the fitting of any torpedo equipment in capital ships and cruisers. Possibly there is an *ex parte* element in this view—the gunnery school, let us say, versus the torpedo school. Far be it from me to claim the qualifications to "take sides." I am writing, I trust, with a perfectly open mind. The moral effect of torpedo warfare is unquestionably very considerable, and without the torpedo the submarine would be worthless. But it comes to this: What did the torpedo accomplish during the great war as a purely naval weapon? Did it prove itself worth while, taking results in relation to organization, personnel, and effort involved in its use? And I would put this question more particularly in reference to battleships and cruisers. One of the penalties of science is that new methods and new appliances are perpetually being evolved, and there is a tendency to feel that unless these methods and appliances are adopted or adapted an unfair handicap may be imposed upon our fighting seamen. I agree that the old axiom that "Men win battles" is incomplete: They win them by possession of, and the skillful use of, weapons. Superiority in weapons should spell victory. But there are decisive weapons and incidental weapons. Two main fleets could join battle without possessing a single torpedo between them, and such an action would run a normal course, probably without the absence of torpedoes being noticed at all. Take away their guns and give them more torpedoes instead, and what sort of action can we picture? The battle would be a supreme test of maneuvering skill, but probably to inflict any damage at all ramming would have to be resorted to.

A Nicaraguan Canal

Merchant Marine Bulletin, December. By Major General Lytle Brown, Chief of Engineers, U. S. Army.—The advantages of Lake Nicaragua and its outlet, the San Juan River, as links for an interoceanic waterway have attracted explorers since their discovery in 1522 by Gil Gonzales de Avila. This discovery resulted in the founding of Granada and the navigation of the lake and river ships trading regularly between Granada, South America, and Spain until as late as 1637.

At subsequent intervals seven different routes for a canal across Nicaragua have been explored. All contemplated the use of the San Juan River and Lake Nicaragua, and four of these proposed also to include Lake Managua. The first authentic instrumental survey was made in 1850 by Colonel Orville W. Childs for a company controlled by Cornelius Vanderbilt, and though no canal was built, this company operated

vessels on the river and lake during the "Gold Rush" to California.

Colonel Childs projected the route from Greytown up the San Juan Valley to the lake, across the latter to the mouth of the Rio Las Lajas, thence across the western divide and down the valley of the Rio Grande to Brito harbor. This route has been the basis for all subsequent surveys, excepting in part that made by A. G. Menocal, civil engineer, U. S. Navy, in 1884, who proposed a project varying materially on the section east of Lake Nicaragua, in that he proposed to subsitute a high dam at Ochoa, for the series of low ones previously projected across the San Juan River, and to excavate a canal from Ochoa on practically a direct route, to Greytown, through the San Francisco basins to the east divide, thence down the valley of the Rio Deseado, thereby effecting a saving of about 6.5 miles in distance.

The Childs or San Juan Valley route has since been recommended, with minor modifications, by Commander E. P. Lull, U. S. Navy, who resurveyed it in 1872. It was also recommended, after more elaborate surveys and explorations, by the Nicaragua Canal commission in 1899 and by the Isthmian Canal commission in 1901. These commissions adopted Menocal's plan for a high dam, which converted the river above into an arm of the lake, but moved the site from Ochoa just below the mouth of the Rio San Carlos to Conchuda, several miles above, to avoid endangering the dam through the sudden and heavy floods from the San Carlos. The commission's project, however, followed the San Juan Valley from Conchuda to Greytown, rather than the Deseado, as a canal on the latter route involved high earth embankments across the San Francisco swamps, which it was thought could not be safely constructed and maintained.

The Menocal or Deseado valley route was adopted by the Maritime Canal Company, incorporated under an act of Congress, approved February 20, 1889, for the purpose of building a canal in Nicaragua, and construction was begun, but the company failed to carry out the project. It was reported as being practicable in October, 1895, by the Nicaragua Canal board, appointed by the President of the United States, but the report referred to the probable difficulty of constructing and maintaining the Ochoa Dam and the San Francisco embankments, and suggested that alternate routes be examined before a final selection of a project.

The Isthmian Canal commission examined both the Panama and Nicaragua projects in 1901 and recommended the latter mainly because it was cheaper, due to the price asked by the new Panama Canal Company for its rights, privileges, and plant at Panama. Later the company reduced its demands, making the Panama project the cheapest, so the recommendation was changed and the latter was acquired by the United States.

A convention entered into in 1916 by the United States and the Republic of Nicaragua granted the former the exclusive right to construct and operate a canal across Nicaragua, the consideration being $3,000,000. Aside from acquiring this right, no further steps have been taken toward a canal project at Nicaragua since 1901, until the survey now in progress was authorized by Resolution No. 99, Seventieth Congress, which directed surveys and estimates for a canal in Nicaragua and for ascertaining the practical ability and approximate cost of increasing the capacity of the Panama Canal by adding locks and other facilities. The president appointed two retired Army engineers and three civil engineers as members of the Interoceanic Canal Board to assist the Secretary of War and the chief of engineers in these studies. The investigations relating to the Panama Canal have been assigned to the governor of the canal. The Nicaragua surveys were begun in October, 1929, by a battalion of U. S. engineers under the general supervision of the chief of engineers.

The explorations and surveys of thirty years ago were thoroughly executed, but the dimensions of the prism and structures and the required water supply for the canal then in view are entirely inadequate for the traffic demands and larger vessels that exist today or that may be anticipated in the near future. The alternate routes suggested warranted further investigation, as the Deseado project, though six and a half miles shorter, more direct and cheaper, was rejected because the construction and maintenance of high embankments on troublesome foundations seemed more formidable

at that time than it does today in the light of the experience gained in the meantime.

For these reasons it has been necessary to check and extend the topography of former surveys, rectify the alignment by eliminating sharp curves, investigate alternate embankment locations, collect additional data for comparing alternate routes, explore new sites to accommodate larger locks, investigate promising dam sites and collect additional hydrographic data to determine the sufficiency of the water supply for a canal that will draw 9,300,000 cubic feet of water from the lake for each ship transit, instead of 7,000,000 cubic feet formerly estimated, with proportionate increases for other purposes.

The engineer troops in Nicaragua are actively engaged in securing the data indicated above. The force is located along the entire route, in detachments or field parties occupying tent camps located at convenient points. The usual difficulties incidental to work in the tropics has been encountered, the most serious being transportation of men and supplies. The excessive rainfall on the eastern slope and the consequent high water in the San Juan and its tributaries makes navigation hazardous and makes the extensive swamp areas along the line almost impassible. Under such conditions the engineer troops have remained remarkably healthy and made good progress; the survey is finished except for further subsurface explorations to determine the nature of the materials to be excavated and the suitability of the lock foundations. It is anticipated that all field work will be completed in April, 1931.

Plans of the canal will depend upon the results of the investigations now in progress. Present indications are that, in general, ships will be lifted from sea to lake level, about 110 feet, through a series of three locks, on both the Caribbean and Pacific slopes, each lock being 1,200 feet by 125 feet in the clear. The length of the canal between oceans will be approximately 177 miles. Of this about 22 miles will be at sea level. The remaining 155 miles, at lake or summit level, will be made up of 35 miles of excavated channel, 70 miles of lake navigation and 50 miles on the San Juan River, between the lake and Conchuda Dam.

Arguments advanced for a canal at Nicaragua are that it is required for diplomatic, military, and economic interests. There seems no doubt that the canal would stimulate the development of Nicaragua and the adjacent republics and make for closer international harmony. The strategic value of a second canal across the isthmus is a subject regarding which opinions differ and is entirely too broad to discuss in this article.

The determination of the economic value of another canal involves studies of the past and probable future growth of the world's commerce, and of the portion of it that passes over the trade routes that will be influenced by the canal. Such a study is under way, but since the answer cannot be obtained by any exact scientific method, it is certain to remain a subject of controversy between the advocates and opponents of a canal in Nicaragua.

NOTES ON INTERNATIONAL AFFAIRS

From December 4 to January 3

Prepared by Professor Allan Westcott, U. S. Naval Academy

ARBITRATION AND ARMAMENTS

Arms Committee Completes Work.—Following nearly five years of intermittent labor, the preparatory committee for a disarmament conference passed out of existence on December 9 after having completed the framework for a treaty limiting land, sea, and air armaments. The general conference on limitation of armaments, the task of which will be to fill in this framework, will meet probably early in 1932. It will bring to Geneva 2,000 or 3,000 delegates, aside from press representatives, lobbyists, and others, and on its results will depend, according to some judgments, the continuance or downfall of western civilization. While most of the members of the preparatory committee appeared satisfied with their work, emphasizing that for the first time there had been general recognition of the need of some form of international control of armaments, the Soviet delegation refused to have anything to do with the final report and declared the draft convention "both inadequate and sterile." Russia, however, will send delegates to the future conference.

Speaking of the draft convention, Ambassador Hugh Gibson, the American representative on the committee, remarked that it "does not hold out the promise of bringing about the immediate reduction of armaments we would like to see," but "we can at least foresee a stabilization of armaments, and the setting up of machinery to receive and disseminate information on armaments, to educate public opinion, and to prepare systematically for the work of future conferences."

Summary of Draft Convention.—The following summary of the limitation of armament draft convention appeared in the New York *Times* of December 10:

The convention is divided into six parts, dealing with personnel, material, budgetary expenditures, exchange of information, chemical arms, and miscellaneous provisions.

It begins with a blanket article whereby the powers agree "to limit and, so far as possible" reduce armaments by the following methods:

Part I. Personnel. The total number of land, sea, and air effectives is to be fixed. In the Army alone, officers and professional soldiers, including non-commissioned officers, are to be limited separately from the men.

The maximum length of conscript service is to be set for each country.

The conference remains free to reconsider the proposals to limit trained reserves, or the number of conscripts annually called to the colors, or to abolish conscription, which the commission rejected.

Part II. Material. Land material is to be limited by fixing a maximum annual expenditure for it. A convention footnote reminds the conference that nine delegations favored limiting directly the quantity of land material or both the quantity and expenditure.

Naval material is to be limited both as regards expenditure and quantity. In regard to the latter, all methods adopted at London are recommended with these modifications.

Both global and category tonnage limits are to be fixed, but powers whose fleet does not exceed 100,000 tons—the convention is giving this figure as an indivation—may have full liberty to transfer surface tonnage among the various categories, while the transfer rights of other powers may be in inverse ratio to their global tonnage. In either case the special situation of the power concerned and the specific category involved is to be considered in fixing the transfer percentage, and transfers into the submarine class are to be restricted.

The size of the vessels of each category is to be limited and provision made for special and exempt ships.

In air material, the number and total horsepower of the planes in commission, and the immediate reserve are to be fixed, as well as the number, horsepower, and volume of dirigibles. Air expenditure is unlimited.

The powers agree to refrain from seeking to convert civil planes into military machines, or to require civil enterprises to employ a military personnel or subsidize air lines for military ends.

Part III. Budgetary expenditure. The annual expenditure for land, sea and air forces is to be limited. The plan for this is to be established by a committee of experts meeting here on December 11, who will also consider the setting and separate figure for each arm.

Part IV. Exchange of information. Provision is made for detailed information on personnel, such as where stationed at home and overseas; how many naval officers; how many men receive preparatory training, and other points untouched by limitation. Detailed information is to be required on where planes are stationed, the number and horsepower of civilian planes, the expenditure on tanks, artillery, and small arms, and what merchantmen are prepared to carry six-inch guns.

Part V. Chemical arm. Poison gas and bacteria are to be banned in warfare.

Part VI. Miscellaneous.—A permanent disarmament commission is to be established with wider powers than the present Mandates Commission. It is to meet annually and report annually to the League Council, to collect and disseminate information on the status of armament generally and supervise enforcement.

There is a safeguard clause to the effect that a signatory whose security is menaced can suspend the convention temporarily so far as it is concerned, after explaining to the above commission, whereupon the other signatories will agree to "advise"—in other words, to consult—about the situation.

Complaints of violation are to be referred to the above commission, which will investigate and report to the signatories and League Council, whereupon the signatories will again "advise."

A continuity is assured by a provision for the regular reexamination of the armament situation by the conference every so many years and the possibility of any power enforcing the convocation of extraordinary conferences. The denunciation of a treaty is only possible after a certain number of years, and during the session of one of the conferences.

There are reservations attached by one or more powers to nearly all the important articles of the treaty. As a whole it represents the views of only the majority of the commission.

SENATE POSTPONES ACTION ON WORLD COURT.—The U. S. Senate Committee on Foreign Relations on December 12 decided by the close vote of ten to nine to postpone consideration of the World Court protocols until the first session of the new Congress in December, 1931. One of the motives was to avoid an extra session next spring. The three protocols which must be ratified before American entry into the court were sent to the Senate by President Hoover on December 10 with a brief message endorsing them and recommending their ratification after emergency relief and appropriations legislation had been disposed of.

UNITED STATES AND LATIN AMERICA

PROBLEMS OF RECOGNITION.—Again the American State Department faced a problem regarding the recognition of revolutionary governments in Latin America when Guatemala in the course of December succeeded in having four different presidents. Upon the withdrawal of President Lázaro Chacón due to illness, he was legitimately succeeded by acting President Palma, who was duly recognized by the United States government. One day after this recognition Palma was overthrown with some slight bloodshed by General Manuel Orellano, who then took over the office of president. Following the policy originally formulated by Secretary of State Hughes and subsequently embodied in the Central American treaty of 1923, barring recognition to any Central American government set up by revolution or *coup d'état*, the United States thereupon declined to recognize the Orellano régime. In this instance the refusal appeared to work to good effect, for Orellano resigned on December 31, and gave the office over to José Andrade, a liberal member of Congress, under circumstances which pointed to a future election by constitutional procedure.

Though not a party to the Central American treaty of 1923, the United States has acted in accordance with it, notably in the case of Nicaragua, but has fortunately not felt called upon to apply it to South American countries such as Brazil, Argentina, or Peru. A sharp criticism of this policy of attempting to check revolutions by withholding recognition is made by Lawrence Dennis, former American representative in several Central American countries, in the January issue of *Foreign Affairs*. Mr. Dennis presents strong arguments for following the ordinary procedure of international law in recognizing *de facto* governments, however they may have come into power.

MARINES KILLED IN NICARAGUA.—On January 1, while a patrol of U. S. Marines were at work on a telephone line near Apali in the jungle country of northern Nicaragua, they were ambushed by a band of outlaws said to be operating under Sandino. Eight marines were killed or wounded after two

hours' fighting. The wounded were taken to Managua by airplane.

MARTIAL LAW IN CUBA.—Amid renewed student disorders and rumors of his own resignation President Machado of Cuba on December 11 again suspended constitutional guarantees, this time throughout the island, for a period of thirty days. This action takes away freedom of speech, freedom of the press, and the rights of assembly and habeas corpus. It was preceded by a cabinet reorganization in which two ministers were changed and two new portfolios created. Following an alleged conspiracy to seize army barracks throughout Cuba, the President on January 1 appointed a commission for a military investigation.

EUROPEAN POLITICS

NEW FRENCH MINISTRY.—After a precarious existence for a little over thirteen months, the Tardieu government in France was forced to resign on December 4 when defeated in the Senate by the close vote of 147 to 139, following bitter attacks from the left on both its foreign and domestic policies. In view of the almost equal strength of the right and left parties in the French parliament the forming of a new ministry proved a difficult task. After the failure of Senator Louis Barthou to organize a cabinet based on a coalition of the center parties, and similar failure on the part of Senator Pierre Laval, due to refusal of the Radical Socialists to collaborate with a Nationalist group also represented, the problem was at last solved on December 23 by the formation of a left ministry headed by Theodore Steeg, with five former premiers as ministers, including Briand (Foreign Affairs), Leygues (Interior), Barthou (War), and Paimlevé (Air). M. Steeg was French Minister of the Interior through the war period and was then governor of Algiers and later of Morocco. The ministry narrowly survived its first vote of confidence by a majority of seven in the Chamber of Deputies, and then secured a brief lease of life when Parliament adjourned until January 13.

FRANCO-ITALIAN NAVAL DEADLOCK.—The change of government in France further complicated the friendly efforts of American and British diplomats to reconcile the naval disagreement which has prevented France and Italy from joining fully in the London Naval Treaty. Ambassador Hugh Gibson reported to Washington in December that some measure of progress had been made; and during the month Robert L. Craigie, British naval expert and attaché of the foreign office, also conferred with Foreign Minister Grandi and with René Massigli, French foreign office specialist in naval matters. Little was accomplished, and there was slight prospect even of a continuance of the mutual agreement not to take up new naval construction, which was to expire December 31. France is financially better able to undertake new building, and is hence not greatly dissatisfied with the present state of affairs.

MOVES AGAINST FRANCO-BELGIAN ALLIANCE.—At the close of December it was reported that Socialist leaders in Belgium had renewed agitation against the military convention of 1920 between France and Belgium to coöperate against aggression on the part of Germany. The Socialist and Flemish parties in Belgium hold that the necessity for the alliance is largely removed by the Locarno Treaties, and that Belgium would be better off if she recovered full independence of action, even though she should not return to her former status of neutrality. Revocation of the treaty would doubtless be welcomed in England, which has viewed it with some suspicion as counter to the traditional British policy of keeping the continental coasts of the channel outside the dominance of any major continental power.

GERMAN REICHSTAG APPROVES FINANCE MEASURES.—Chancellor Bruening in Germany secured a period of freedom from parliamentary interference with his economy program when the Reichstag on December 12 adjourned for sixty days. Preceding its adjournment the chamber twice by substantial majorities defeated motions to revoke the executive decress by which the government has put into effect its drastic measures for financial rehabilitation, and which will bring about a budget saving of $350,000,000.

ADMINISTRATIVE CHANGES IN SOVIET REPUBLIC.—In the course of December Alexei Rykoff, official head of the Soviet government as president of the Council of Peo-

ple's Commissars, but long under suspicion for his moderate leanings, was ousted from this and nearly all his other posts in the government and in the Communist party. His successor as president of the Council is Vyacheslav Molotov, long prominent among Communist leaders, a newspaper man who was one of the founders of *Pravda*, and a loyal lieutenant of Stalin. These and other changes directed against leaders not in full sympathy with Stalin's present policies were accomplished very simply by decrees of the Central Control Commission of the Communist Party, thus effectively disposing of any lingering notion that the party is not the controlling element in the goverment. Stalin himself has for the first time taken an official position by becoming a member of the Council of Labor and Defense.

Along with these changes in leaders, the Central Control Commission issued a decree reorganizing the food distribution system, calling for more stringent measures against private traders, and aiming at the restriction of food supplies to Communist supporters and workers. There is a shortage of both food and clothing in parts of Russia distant from the centers of production, though in the great agricultural, mining, and manufacturing enterprises set up under the five-year plan the workers are well supplied.

Treason Trials Ended.—As was expected abroad, the trial of eight Russian engineers for treason in Moscow ended in something of a fiasco when five of them were sentenced to death on December 7 and on the next day all five death sentences were commuted to ten years imprisonment, with prospects that this punishment would not be very stiffly enforced. These instances of clemency on the part of the Soviet authorities were interpreted abroad not as signs of a change of heart but as evidence that the trials were staged chiefly for their effect on the public in arousing antiforeign feeling and distracting attention from the economic hardships under which the Russian people are now laboring.

BRITISH EMPIRE

Willingdon As Indian Viceroy.—In December Viscount Willingdon, retiring governor general of Canada, was named viceroy of India to take the place of Lord Irwin, whose term of office ends in March. Lord Willingdon is a liberal in politics and when governor of Madras made a favorable impression among the native population. He is regarded as the personal choice of King George for the Indian post at this critical period in Anglo-Indian relations.

The Indian Conference.—After a week's intermission during Christmas the Indian Conference resumed work on December 29, with still no signs of a solution for the controversy between Hindus and Moslems over the representation of the latter—who number about 70,000,000 or nearly one-fourth of India's total population—in the provincial and federal legislatures. The Hindus are willing to accord proportionate representation, but wish the Moslem representatives to be elected by joint vote, rather than separately. On the other hand, the newly organized All-Indian Moslem League would insist further on constitutional guarantees of adequate Mohammedan representation not only in legislatures but in cabinets and public services, and on other guarantees relating to the Punjab, the Northwest Frontier Province, and Baluchistan, which contain most of the Moslem population.

The various committees of the conference renewed their task of framing a new Indian constitution, and on January 1 the franchise committee filed a final report which advised increasing the electorate from the present 3 per cent to from 10 to 25 per cent of the total population. An encouraging element in the conference is the apparent harmony in the British delegation, the Conservative and Liberal members of which are in accord with Premier MacDonald in his present policy of extending autonomy to India beyond the promises of the Simon Report or the Irwin recommendations.

REVOLUTIONARY DISTURBANCES

Revolt Crushed in Spain.—The revolutionary movement in Spain, which began on December 12 with an uprising of the troops stationed at Jaca in the Pyrenees, was quickly revealed to the government and soon ended in failure. The Jaca rebels were met and overcome by government troops on December 3, after sharp fighting in which over 100 were killed and wounded. Subsequently two of their leaders were executed and others sentenced to imprisonment. Apparently the revolution had been planned long ahead by socialist and republican leaders in col-

lusion with disgruntled army officers, and a general uprising was scheduled for December 15 which was revealed by the premature affair at Jaca. Strikes and labor manifestations actually began on the fifteenth in various provinces, but by moving vigorously and putting the country in a state of seige (under martial law), the government was able to keep these disturbances under control. A novel episode occurred on the fifteenth at Cuatro Vientos airport near Madrid, when Major Ramon Franco, a military aviator who had been imprisoned for disloyalty, broke loose, aroused supporters at the airport, and with three or four planes scattered proclamations over the capital. Franco and his followers escaped by flying across the Portuguese frontier.

Reports from Spain attribute the strong revolutionary feeling there to two general causes, economic depression and the heavy hand of the De Rivera dictatorship. Though the latter has collapsed, the Berenguer government which replaces it is described as "a thinly-veiled dictatorship which does not dictate," and which gives just enough freedom to encourage agitation for change. Economically Spain has not suffered more in proportion to her resources than the rest of Europe, and in October exports exceeded imports for the first time in many years.

TURKISH UPRISING.—From Turkey at the close of December came reports of disturbances due partly to economic causes but chiefly to religious feeling against the abolition of the Caliphate and the government policy of supplanting the old Turkish civilization with western ideas. The revolt, however, was largely confined to the Menemen district in Smyrna province, a region given to fanaticism in religion, and was put down when the province was placed under military rule.

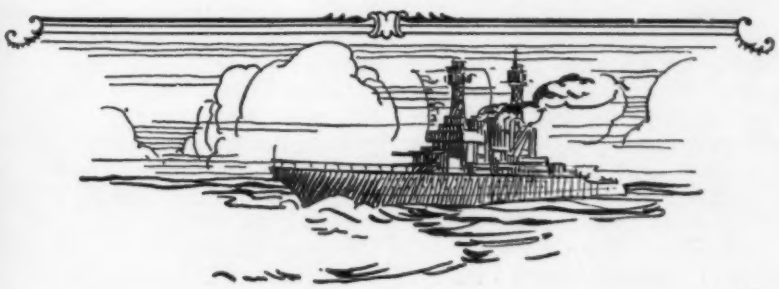
FAR EAST

RELIGIOUS MASSACRES IN KANSU.—From the distant interior province of Kansu in China came reports during December that 30,000 Chinese had been put to death by roving bands of Moslems. The population of the province is only about one-third Mohammedans, but these make up in fanaticism for their lack in numbers. Over 200,000 Chinese were killed there in 1928. The Nanking government has undertaken to send an expeditionary force into the province, despite the difficulties of the long march in winter weather.

ABOLITION OF LIKIN.—December 31 was the date set by the Chinese National government for abolition of the likin, or provincial taxes on goods shipped from one city or region to another A six-months' postponement, however, has been requested by the Manchurian government, and in other more remote districts the enforcement of the new edict will put the strength of Nanking to a severe test.

As a means of increasing the national revenue, though not as a direct substitute for the likin, a new tariff measure was put into effect on January 1 which made a general increase in rates of about 7 per cent, affecting chiefly liquors, tobaccos, automobiles, and machinery and other goods purchased especially by the foreign population. The new tariff is expected to increase revenues by about $40,000,000.

DAMAGES FROM BANDITRY.—Estimates made by the Chinese press in December put the destruction wrought by banditry in Kiangsu province alone at 130,000 killed and $100,000,000 loss of property. Early in December President Chiang left for Kiukiang to assume personal direction of operations against the outlaws, though he returned soon afterward to Nanking.



BOOK DEPARTMENT

Members of the Institute may save money by ordering books through its Book Department, which will supply any obtainable book. A discount of 10 per cent is allowed on books published by the Institute, and 5 per cent on books of other publishers (government publications excepted). Address Secretary-Treasurer, U. S. Naval Institute, Annapolis, Maryland.

WILLIAM L. SIBERT, THE ARMY ENGINEER. By Colonel Edward B. Clark, U. S. Army, Res. Philadelphia: Dorrance and Company, Inc. 1930. $2.50.

REVIEWED BY LOUIS H. BOLANDER

In his book on the ill-fated canal work of the French in the Isthmus of Panama, Colonel Bunau-Varilla, one of the chief engineers of construction, refers to General William L. Sibert as "the engineer without fear and without reproach." In this biography the author fully substantiates General Sibert's right to such high praise. For his whole life has been a record of high achievement and of tremendous tasks well done. From the day he was graduated at West Point in 1884, the general's career has been crowded with duties of the most arduous and varied nature. After gaining considerable experience in river and harbor work at Bowling Green, Detroit, and Little Rock, he was sent to the Philippines where he joined the staff of General Otis as his chief engineer. Under him he made a splendid record for himself in keeping the lines of the Manila and Dagupan Railroad open for General MacArthur's advancing columns.

After the campaign was over he returned to the States and was ordered to the post of engineer in charge of the Pittsburgh district. Here he was instrumental in putting through the project that was to insure a nine-foot channel for the Ohio River. But when, in 1907, President Roosevelt appointed him a member of the Isthmian Canal Commission, and he was entrusted with the building of the Gatum locks and dam, he was ready for the crowning achievement of his career. He differed sharply with Colonel Goethals on certain engineering problems connected with the Miraflores Locks, and certain interests would have removed him, but he kept his post. In this controversy between Sibert and General Goethals, Colonel Clark is most decidedly a Sibert partisan. After the canal was finished Sibert was sent to China in the interests of the American Red Cross to devise plans for flood relief. In June, 1917, he was ordered to France to command the First Division of American regulars, but was recalled after a few months to become chief of the Chemical Warfare Service. The net result of his accomplishment in this duty was that by the time of the Armistice the United States was producing more lethal gas than England, France, and Germany combined. After his retirement he took charge of the rehabilitation of the port of Mobile in his native state, transforming that harbor from an almost decadent port to a modern ocean terminal. Later he became identified with the Boulder Dam project. Now at the age of seventy he is living a peaceful life on his Kentucky farm.

Colonel Clark writes this account of his life with the facility of expression of the veteran newspaper reporter, and shows keen understanding of military and engineering problems. He enlivens his book with many amusing anecdotes, gleaned probably from the general's own lips. The chief fault of the book is that it quotes at too great length

from various writings by and about the general. The book would be more readable if the writer had condensed some of these long quotations in such a manner as to give the vital points without unnecessary verbiage. An index would have added much to the reference value of the work.

ADDITION-SUBTRACTION LOGARITHMS (To five decimal places). By L. M. Berkeley. New York: White Book and Supply Company. 1930. $3.25.
See page 207 this issue.

REVIEWED BY COMMANDER H. E. ROSSELL (C.C.), U. S. Navy

The addition logarithm of two quantities, a and b, is the logarithm of the sum of the quantities; the subtraction logarithm is that of the difference of the quantities. The above statements may be expressed algebraically as follows:

$$\text{Addition logarithm} = \log (a + b)$$
$$\text{Subtraction logarithm} = \log (a - b)$$

The author has compiled in a most convenient manner a five-place table which permits of the determination without interpolation of addition and subtraction logarithms from the logarithms of the two basic quantities, a and b.

To get the addition logarithm of a and b, one enters the table with the difference of the logarithms of these quantities as an argument and picks therefrom a function called A. The sum of A and the larger of the two logarithms is the addition logarithm. With the same argument, a function S is picked from the table and is subtracted from the larger of the two logarithms to get the subtraction logarithm.

By means of addition-substraction logarithms used in conjunction with common logarithms, it is possible to compute readily the values of expressions which cannot be handled conveniently by the latter only. For example, an expression such as

$$\left(\sqrt{\frac{q^2}{4} + \frac{p^3}{27}} - \frac{q}{2}\right)^{1/3}$$

can be evaluated quickly and accurately by the use of common logarithms and the addition-subtraction log table under discussion but not by common logarithms alone.

Trigonometry is a fruitful field for the advantageous use of addition-subtraction logarithms. If three determining parts of any plane or spherical triangle be known, it is possible to solve the triangle readily by common logs and addition-subtraction logs. Only four formulas, the cosine and sine laws of plane and spherical trigonometry are necessary. The other trigonometric farmulas in general use for solving plane and spherical triangles have been deduced for the purpose of obtaining expressions which can be computed with facility by common logarithms alone.

Of course working out sights in navigation consists merely of solving spherical triangles. If it be desired to use the line of position method rather than the time sight method, one may use the cosine law, expressed as follows:

$$\sin h = \sin d \sin L + \cos d \cos L \cos t$$

(h being the altitude of the body observed, d its declination, t its hour angle, and L being the latitude of the observer)

The computation may be performed with facility by addition-subtraction logs and common logs. If graphic log sine and log cosine tables, similar to the Lacroix and Ragot graphic log tables of numbers were used in conjunction with the addition-subtraction log tables of the author, the computation could be made, perhaps, in as short a time as by means of Dreisonstok's tables. Moreover no interpolation would be necessary.

As the author points out, the fundamental conception of addition-subtraction logarithms was due to the Italian mathematician Leonelli, but the first practical table was published by Gauss. The use of Gauss' table, which was studied by midshipmen at the Naval Academy some years ago, involves considerable interpolation. The success of the author in entirely eliminating the necessity for interpolation in the use of his table should make for a more general recognition among mathematicians, astronomers, navigators, and computers of the wide application of addition-subtraction logarithms.

JEB STUART. By Captain John W. Thomason, Jr., U. S. Marine Corps. New York: Charles Scribner's Sons. 1930. $5.00

REVIEWED BY LIEUTENANT COMMANDER T. L. GATCH, U. S. NAVY

This is a biography of the honest, old-fashioned, hero-worshiping type wherein

the author does not undertake to think for his subject. A fine book that leaves a good taste, that makes an American square his shoulders.

First, one criticism: It is well nigh impossible for the ordinary reader to follow a description of a terrain without a map of some kind to aid him. Military operations cannot be comprehended without a knowledge of the terrain. Victor Hugo's classic description of Waterloo may be an exception—but that is scarcely a military account. There are a few simple sketch maps in this book that are so satisfactory that one misses them all the more in the many places where they are omitted.

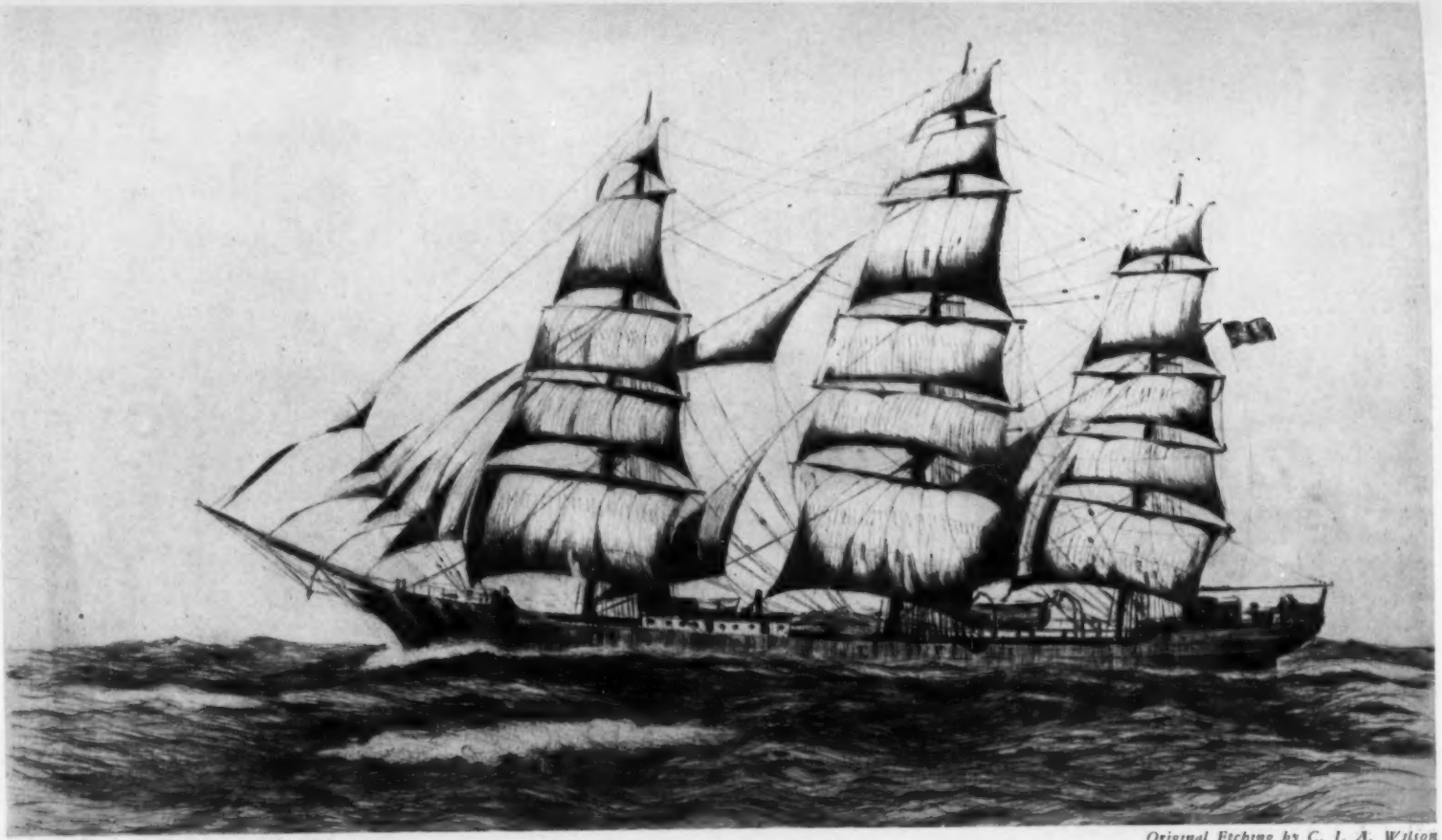
For the rest, the book can hardly be too highly praised. To the naval officer, whose avocation should be the studying of operations ashore, a great lesson is presented: The striking success of the South in the first years of the war was due, more than to anything else, to great superiority in the service of information and security. And that was Jeb Stuart and his cavalry. The audacious maneuvers of Lee, particularly his spectacular division of forces in the very face of a much stronger enemy at the second Bull Run, would have been sheer madness had his cavalry been *any* other than as it was.

Grant and Sheridan came on the scene, and Stuart was killed. Six weeks or so later Grant threw his army across the James on a single pontoon bridge that was over half a mile long, and for two or three days Lee did not know that it had been done. Petersburg was saved by what lacked little of being a miracle. One wonders: Could that have happened had Stuart lived? Anyway, its like had never happened while Stuart did live.

As to Gettysburg, which is held against Stuart to this day in the South, one must agree with the author that Stuart's absence immediately preceding the battle was of little consequence. Lee was attacking throughout the three days; he did not have to. It is reported that about 5:00 P.M. on July 1 Longstreet said to Lee: "We could not call the enemy to a position better suited to our plans. All that we have to do is to file around his left and secure good ground between him and his capital." "If he is there tomorrow," replied Lee, "I will attack him." "If he is there tomorrow it will be because he wants you to attack. . . ."

Sins of omission by the commander of light forces may be serious enough, but sins of commission may be much worse; and with an enemy doing his utmost to help in this latter transgression, they may be of dangerous facility. Supineness is the worst of all military sins, but next to that, perhaps, a fault on the contrary side—too vivid an imagination, "making pictures for themselves," over-zealous thinking and reporting. Probably the highest praise a commander of light forces may receive is that Lee paid to Stuart upon news of his death: "He never brought me a piece of false information."

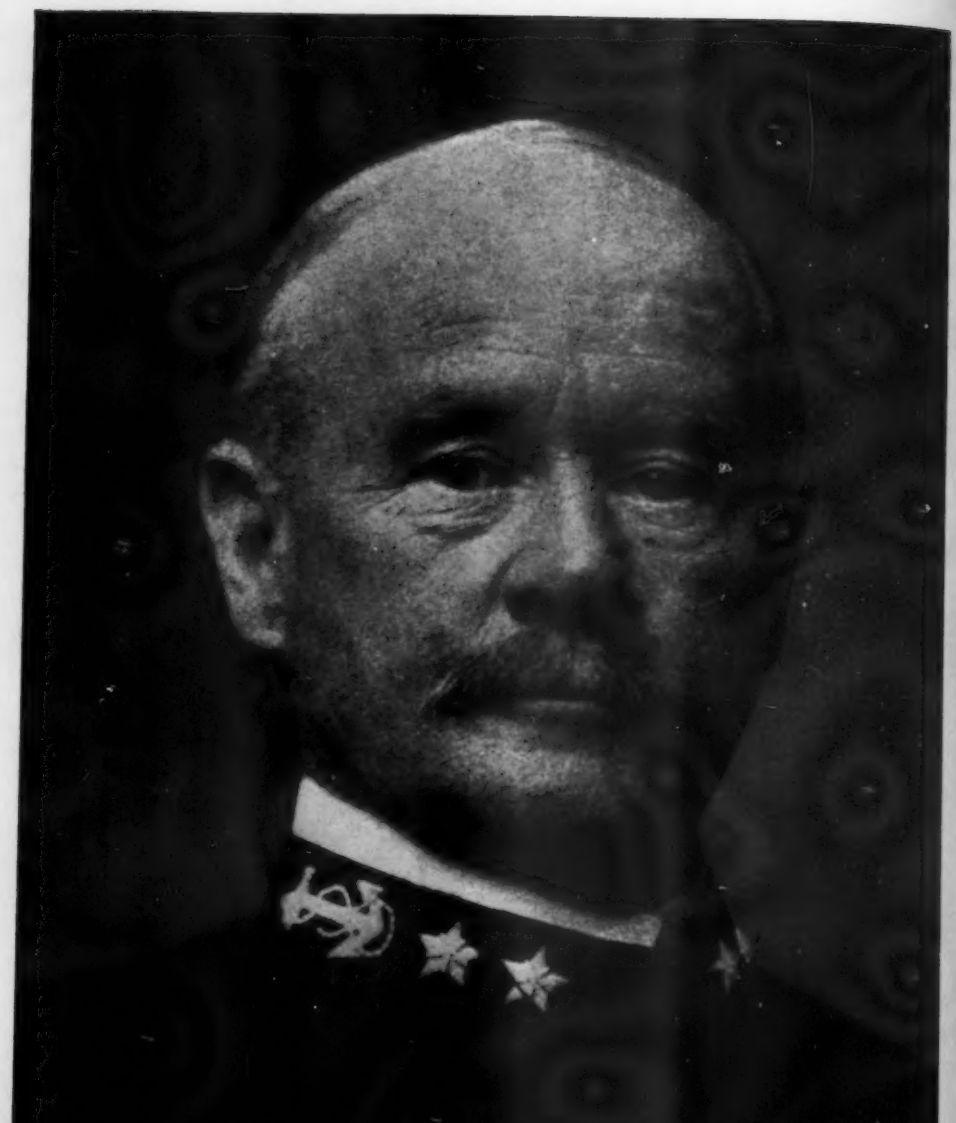
In these later days, such a book as this one of Captain Thomason's serves the great purpose of putting a tingle in red blood. There have been greater men than Jeb Stuart; there have been very few more lovable; there have been fewer yet to whom could be applied more appropriately the description *sans peur et sans reproche.*



Courtesy Bendann Art Gallery, Baltimore

ON THE STARBOARD TACK-SHIP *TIMANDRA*

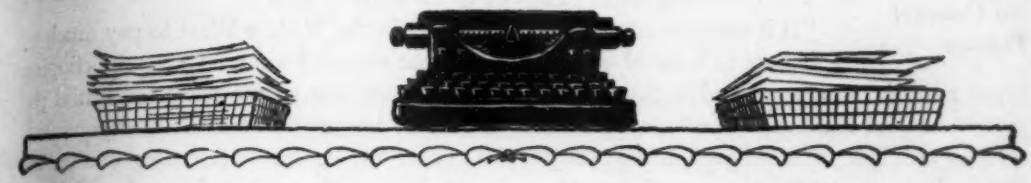
Original Etching by C. J. A. Wilson



REAR ADMIRAL HENRY C. TAYLOR, U.S.N.

UNIV. OF MICH.

SECRETARY'S NOTES



An Appreciation Through the kindness of one of the readers of the Institute, the photograph shown on the opposite page has been furnished as an appreciation of Admiral Taylor, who was looked upon by many as the ideal naval officer. The photograph better portrays the intelligence and personality of this officer than the one shown in the December issue. The Institute publishes, with pleasure, the following notes, additional to those in the previous issue.

"Admiral Taylor created the General Board of the Navy and served as one of the original members. His most conspicuous duty was as chief of the Bureau of Navigation during Mr. Roosevelt's administration, where, under the conditions of the time, he occupied a position corresponding to that of the present chief of Naval Operations. His untimely death deprived him of the opportunity to command the Fleet.

"President Roosevelt had a very high opinion of Admiral Taylor's character and ability and consulted him freely in regard to the Navy and upon matters of international policy, a subject on which he was eminently qualified to give advice.

"During his service as chief of the Bureau of Navigation, Admiral Taylor planned and directed the most powerful concentration of the fleet that had been seen up to that time. The North Atlantic Fleet, the European Squadron, and the South Atlantic Squadron were assembled at Culebra, West Indies, under the command of Admiral Dewey, Admiral Taylor serving as chief of staff. The concentration was made in the execution of a strategic problem on a scale hitherto unknown in the naval service. The impression produced and the lessons learned at this time had a far-reaching effect upon the later development of our Navy."

Annual Meeting The annual meeting of the Institute will be held at the Officers' Club of the Naval Academy on Thursday, February 19, at 4:00 P.M.

Nothing New Under the Sun Lieutenant Commander W. M. Falconer, U. S. Navy (Retired), has called the editor's attention to an interesting translation from the *Odyssey:*

Many times I have heard the tale of the temporarily disgruntled bluejacket, who, when asked what he was going to do when paid off, replied, "I'm going to put an oar over my shoulder and march inland and when somebody asks me what that is, there I'm going to settle."

Homer in Book XI, the *Odyssey* makes Teiresias in Hades, warn Odysseus (Ulysses) that his death will come from the sea, and tells him on his return home to take with him "a shapen oar, till thou shalt reach men who know not the sea, nor eat salt mixed with their food, nor know anything of purple-cheeked ships, nor of shapen oars that are the wings of ships. I will tell thee a sign so plain that it cannot escape thee; whenever another traveler encountering thee shall say it is a winnowing fan thou art carrying on thy strong shoulder, then do thou drive thy shapen oar into the ground and make goodly sacrifice to Lord Poseidon (Neptune)."

"We Build a Navy"

This interesting book by Commander H. H. Frost, U. S. Navy, at $3.60 is well worth the attention of those who wish to know more of the development of our present-day Navy.

An Unusual Tribute

The following letter has come to the editor's desk:

"It is most unusual for a newspaper in the Middle West to pay much of a tribute to a naval officer and for that reason I am enclosing the clipping of an editorial that appeared in the *Illinois State Register,* one of the most influential papers in central Illinois. Its editor, Mr. V. Y. Dallman, has made several 'newspapermen cruises' and is a great believer in the Navy and a rooter for it. His last cruise was on the *Pennsylvania* in 1925 when we went to Hawaii and it was there that he met and knew 'Ziegie.'

"Mr. Dallman talks so much about the Navy that he is known locally as the 'Admiral of the Sangamon,' the Sangamon being the small river on which Springfield is located.

"I have thought that you might find a way to make use of the very unusual tribute paid by the 'Admiral of the Sangamon' to Admiral Ziegemeier."

"ZIEGIE!"

If you've never climbed a steel ladder on the mast of a battleship which is rolling in heavy waves two thousand miles at sea on a pitch-dark night you've missed a thrill!

Such were the conditions under which Admiral H. J. Ziegemeier led the writer of these words up to the bridge on the battleship *Pennsylvania,* flagship of a division of capital ships assigned with the rest of the "Blue" fleet to capture the Hawaiian Islands a few years ago.

Rigid orders to darken ship were not relaxed until daylight! All night we peered through darkness from the bridge standing near the side of "Ziegie"—as Admiral Ziegemeier was affectionately known by the officers!

He was tireless. He felt the responsibility of taking those millions of dollars worth of ships with their convoys of submarines and destroyers and their thousands of officers and men through the perils of darkness as we crept undiscovered within range of the giant guns near Kaena Point, Island of Oahu!

Radio silence was enforced for three nights and darkness prevailed. We newspaper men could not send or receive messages. Well do we recall how "Ziegie" smiled that sweet, friendly, significant smile as he said:

"Admiral! We have the press muzzled! The fleet of the Sangamon is at our mercy!"

And then came a climax to the weird and wonderful picture of "war" which was glorious! A gentle touch of light on the eastern horizon grew gradually brighter. A grim mountain range frowned at us not far off our port beam. Fleecy clouds settled down like curtains as if to conceal the mountain peaks from an approaching enemy. They looked like mountains of mother of pearl! Then behold! The sun, like a great ball of glittering gold, flooded the battle fleet with radiant rays, smoke belched from the defense guns in the foothills, the fleet let go her showers of shot and shell, combat planes from the battleships and air carriers filled the air and the battle was so realistic it made one shudder at the power of modern machines of destruction and death!

"Ziegie" turned to me and said pensively:

"Death! Death! Death! That is the echo of each gun—and how prophetic!" He smiled of death to come!

Thursday came news to Springfield of the death of "Ziegie" at Bremerton, near Seattle, Washington!

What a beautiful character he was! He represented the finest traditions of the American Navy! He loved America! He loved honor in private and public life! He loved his home, his friends, his duty!

And oh, how "Ziegie" could smile his way into the innermost depths of your heart!

The press is not muzzled today, "Ziegie," for we are saying that when you emerge from the darkness into the light your sweet humanity which prompted enlisted men to say of you: "We'd go to Hell, for that fellow!" will win for you a place so richly deserved in—Heaven!

And great waves roll
And toss and churn
Upon a restless sea
As death bells toll
And make me yearn
More "Ziegie" smiles to see.
—Admiral

Swann's Etchings In the December issue were reproduced some etchings of Don Swann. Approximately a hundred dollars worth of these etchings have been sold. Others are still available, and the Navy Relief will benefit by any further sales.

"Oregon" Photographs In the January issue the photographs of "Chief Engineer R. W. Milligan of the *Oregon*," "Action," and "The Goal at the End of 15,770 Miles," pages 75, 76, and 78 respectively, were obtained by the author of the article from the Historical Section of the Office of Naval Intelligence, Navy Department. These were obtained from a set that was furnished to the Historical Section by a naval cadet attached to the *Oregon* 1897 to 1899. The courtesy note on the photographs should have given credit to this source.

Photographs and illustrations The editor is anxious to obtain selected photographs of the general nature of those usually published in the PROCEEDINGS. He hopes that members who have suitable pictures will give the Institute opportunity to purchase them for use in this publication.

Institute books Revised editions of *Exterior Ballistics and Ballistic Tables; Principles of Naval Architecture and Warship Construction;* and *Radio Manual* have just come from the press. A revision of *Internal-Combustion Engines* is now in press.

MAR 4 1931

PUBLICATIONS

U. S. NAVAL INSTITUTE, ANNAPOLIS, MARYLAND

By a decision of the Board of Control, all members are allowed a discount of 10% on books published by the Naval Institute and 5% on those of other publishers (government publications excepted).

AVIATION

Aircraft Construction.
Prepared under the direction of Lieutenant Commander F. P. Thomas, U. S. Navy. This book presents aircraft in its general features together with elements requisite to a fundamental understanding of the subject. 1929. 232 pages. $3.00.

Naval Aviation. Revised edition. New illustrations. 1929. 140 pages. $1.75 postpaid.

Airplanes, Airships, and Aircraft Engines.
By Lieut. Albert Tucker (CC), U. S. Navy. 1921. 436 pages. $3.50 postpaid.

ENGINEERING

Naval Auxiliary Machinery.
Compiled by officers of the Department of Engineering and Aeronautics at the Naval Academy, this book covers auxiliaries used in the naval service. 1929. 152 pages; 11 folders; many illustrations. $3.50 postpaid.

Principals of the Basic Mechanisms.
By Lieut. Comdr. R. N. S Baker (CC), U. S. Navy, and Associate Professor W. E. Farrell, U.S.N.A. 1926. 135 pages. $3.75 postpaid.

Engineering Materials and Processes.
Is the successor of Danforth's *Mechanical Processes.* By Lieut. Comdrs. G. B. Ashe and J. I. Hale (CC), U. S. Navy. Reprinted 1930 with slight changes and corrections. 267 pages. $2.50 postpaid.

Internal Combustion Engines.
By the Department of Engineering and Aeronautics, Naval Academy. Third revised edition. 1929. 326 pages. $3.40 postpaid.

Naval Reciprocating Engines.
Compiled by Lieut. Comdr. L. P. Bischoff, U. S. Navy. Some material has been taken from *Naval Reciprocating Engines and Auxiliary Machinery,* by Barton and Stickney, and new material added. 1929. 208 pages; many illustrations. $2.50 postpaid.

Marine and Naval Boilers.
Compiled by officers of the Department of Engineering and Aeronautics, Naval Academy, this text has been completely rewritten with the exception of Chapters VI and X. 1929. 194 pages; 16 folders; many illustrations and diagrams. $3.00 postpaid.

Naval Turbines.
By Commanders O. L. Cox and M. A. Libbey, U. S. Navy. 1924. 241 pages with many illustrations and drawings. $5.00 postpaid.

Storage Battery Manual.
By Lieutenant Commander L. C. Dunn, U. S. Navy. 1920. 400 pages. $5.00.

LANGUAGES

French Nautical Phrase Book and Reader.
By Professor P. J. des Garennes, U.S.N.A. 1921. 181 pages. $1.50 postpaid.

A Spanish Nautical Phrase Book and Reader.
By Professor Arturo Fernandez, U.S.N.A. 1925. 175 pages. $2.00 postpaid.

Writing and Speaking: a Handbook for Naval Officers.
By Professor Carroll S. Alden, U.S.N.A. (This book replaces *Composition for Naval Officers.*) 1927. 359 pages. $2.50 postpaid.

LAW

International Law for Naval Officers.
By Comdr. C. C. Soule, U. S. Navy, and Lieut. Comdr. C. McCauley, U. S. Navy. 245 pages. Revised 1928 by Lieut. Comdr. C. J. Bright, U. S. Navy. $2.00 postpaid.

Constitutional Law.
Reprinted 1924. By H. J. Fenton, M.A., LL.D. 351 pages. $2.25 postpaid.